Manchurian Plague Prevention Service

Reports, 1925–1926.

⟨Being Volume V of the Series⟩

NORTH MANCHURIAN PLAGUE PREVENTION SERVICE REPORTS

(1925-1926)

(Being Volume V of the Series)

EDITED BY

WU LIEN TEH, M.A., M.D., B.C. (Cantab.), M.D. (Tokio),

Hon. Litt. D. (Peking): LL.D. (H'kong): Sc.D.: C.P.H. (J'Hopkins).

Director and Chief Medical Officer of the Service; Physician Extraordinary to the President of China; sometime Scholar and Research Student of Emmanuel College, Cambridge; University Scholar and Gold Medallist in Clinical Medicine St. Mary's Hospital, London; Fellow of the Royal Institute of Public Health, Royal Society of Tropical Medicine, Royal Asiatic Society; Original Member of the Academy of Letters, China; Chairman of the International Plague Conference, Mukden 1911; ex-President of the National Medical Association; Foreign Member, Society of Microbiology, Leningrad; Editor-in-Chief, National Medical Journal of China; Author of "A Treatise on Pneumonic Plague", etc.

東三省防疫處

Tientsin:

TIENTSIN PRESS, LIMITED.

1926.

PREFACE.

After an interval of slightly over two years since the last Report (1923-4) was published, I take pleasure in announcing the appearance of Volume V of our Manchurian Plague Prevention Service Reports.

In addition to general hospital and laboratory work, members of our staff have been engaged among other things upon an intensive study of the plague among wild rodents in different parts of the world as well as researches upon the actual method of invasion of the lungs in pneumonic plague.

The sudden importation of Cholera into Manchuria from Shanghai during this summer kept our epidemic and laboratory staff unusually busy, and besides preparing and distributing over 60,000 doses of prophylactic vaccine we were enabled to make an interesting study of the epidemiology of the disease, particularly in connection with an outbreak of 14 cases among the inmates of the Russian-staffed Municipal Hospital of Harbin.

As a result of my year's stay in America (1924-5), principally at Johns Hopkins (Baltimore), the U. S. Hygienic Laboratory (Washington) and the McCormick Institute of Infectious Diseases (Chicago), I have attempted to introduce certain new phases of public health work into this country, and am pleased to state that our Institute in Harbin was the first in the Orient to practise on a wide scale systematic Dick Tests for Scarlet Fever, as well as immunisations for susceptible persons and serum treatment for the sick. For the above purpose our Laboratory has been extended to meet the increased demand for such supplies.

Among the forty odd articles comprising the present Volume, that on "A Report of a Preliminary Health Survey of Pinchiang" may be found instructive by those who have faith in the possibilities of community health work in China. There is no doubt that an immense difficulty awaits pioneers in this field, since trained professional men and women have to seek the co-operation of conservative, perhaps prejudiced, officials in their attempt to obtain beneficial results. But the work has to be accomplished, and wherever a Chief of Police be found who is tolerant and sympathetic the opportunity to introduce modern health measures, however fragmentary, should not be missed. Hence I intend early next year to make a similar health survey of the old Manchurian city of Newchwang, where conditions vary considerably from those of the 30 year-old town of Harbin.

Thanks to the continued support of my chiefs in Peking and Manchuria our Plague Prevention Service has managed since its establishment in 1912 to weather all sorts of political storms and to hold fast to its one ideal, namely, the prevention of disease and promotion of scientific medicine and research. The reputation that it has earned in and out of China has been unselfishly contributed by all members of the staff, to whom the eight-hour limit seems a dead letter !

Our Service has further collaborated with the activities of the Health Section of the League of Nations, both at Geneva and Singapore, and my Treatise on Pneumonic Plague has just been published by the League at the former city.

Finally, I wish to express my deep appreciation of the personal interest taken in our welfare by His Excellency Marshal Chang Tso Lin, who has kindly written a preface in Chinese for this volume.

As in past years, the Tientsin Press, Ltd. has been responsible for the printing of the English edition, while the Chinese one has been undertaken by Hsin Hua Press of Pinchiang, Harbin. The four coloured plates have been done by the Commercial Press, Ltd., Shanghai.

WU LIEN TEH.

Harbin, December 1st, 1926.

濱江防疫醫院模範肺疫病室
NEW PNEUMONIC PLAGUE WARD, HARBIN HOSPITAL 1926.

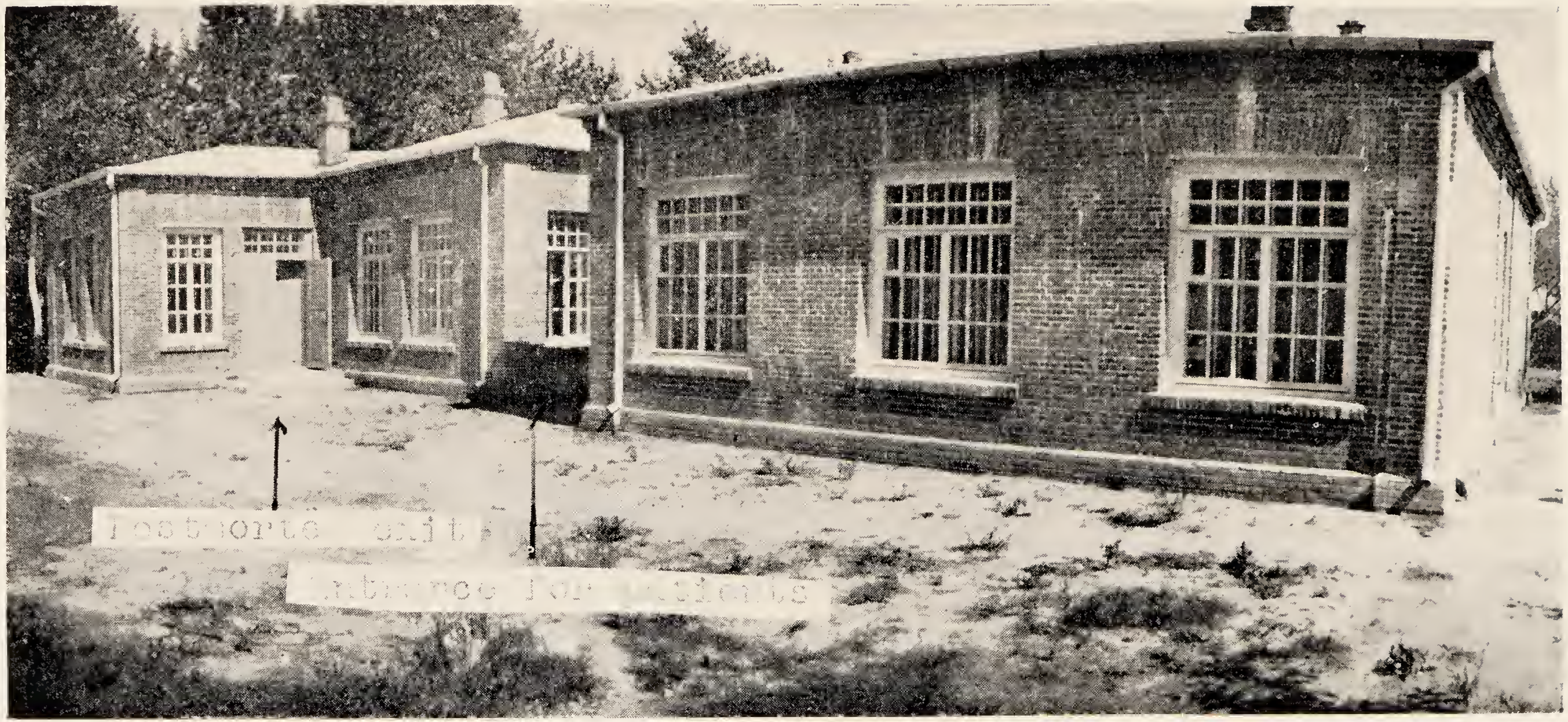


TABLE OF CONTENTS.

LIST OF ILLUSTRATIONS.

Frontispiece—New Pneumonic Plague Ward, Harbin Hospital 1926.

A SYSTEMATIC EXPERIMENTAL STUDY OF THE PATHOLOGY OF PNEUMONIC PLAGUE IN THE TARABAGAN AND SISEL (SUSLIK).

TABLE OF CONTENTS.

A SYSTEMATIC EXPERIMENTAL STUDY OF THE PATHOLOGY OF PNEUMONIC PLAGUE IN THE TARABAGAN AND SISEL (SUSLIK).

(From the Laboratory of the Manchurian Plague Prevention Service, Harbin).

I INTRODUCTION.

Experimental plague infection of arctomyidae through the respiratory tract has been performed several times (Strong 32, 33, Tshurilina and Nossina 34, Tsurumi 35, 36). The most exhaustive experiments in this connection were performed by Wu and Eberson (40) and by Wu, Chun and Pollitzer (39). The animals were inoculated either by injection direct into the trachea or by spraying. When infected by these methods they developed either septicemic or better *pulmonary* plague (Strong 1 case, Wu and Eberson 4 cases, Wu, Chun and Pollitzer 3 cases) or they succumbed to 'pneumonia' (Strong 1 case, Tsurumi 4 cases, Wu and Eberson 9 cases, Wu, Chun and Pollitzer 3 cases).

Though in most of the above instances post mortems were performed, no systematic studies of the histological changes were carried out. In order to complete our observations, a fuller series of experiments have been undertaken during the past two years and the results compiled in this report.

Our present observations fall under two groups :

A. Those upon inhaled animals which succumbed spontaneously to plague or were killed in the later stages of illness when showing distinct clinical signs.

B. Those on animals killed at varying intervals after inhalation before any marked symptoms appeared.

For our purposes, the animals used were partly tarabagans (arctomys bobac) and partly sisels—small grey rodents living widely on the Sungari plain (average weight of 220 grms.). These sisels are highly susceptible to experimental plague infection, the mortality being 100%.

II. TECHNIQUE.

(*a*) *Preparing the Emulsion.*

Emulsions of the lungs from plague infected animals were used. At the beginning of our experiments a series of guinea pigs were infected by lung puncture* so as to obtain a highly virulent emulsion.

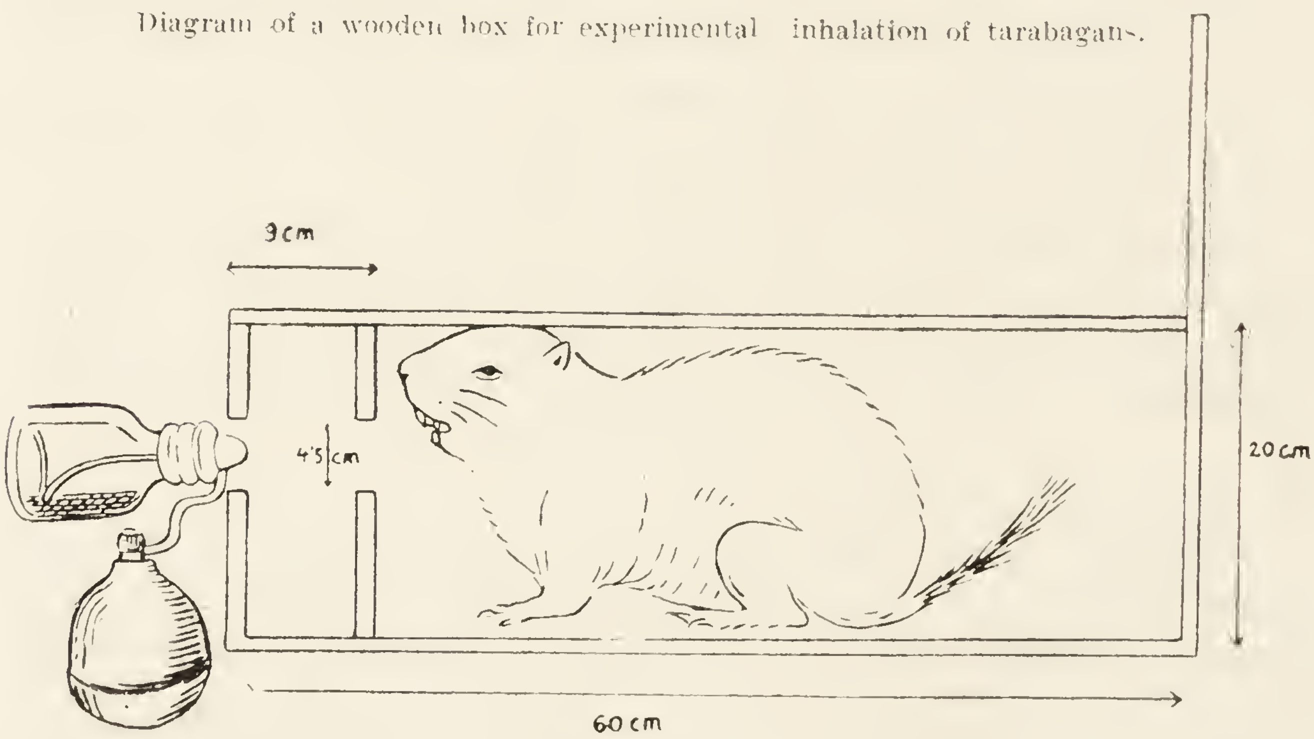
* The technique was generally similar to that of Shibayama (28) with one modification : The inside wire of a needle from a hypodermic syringe was dipped into the infecting material (lung) and then drawn back into the needle. The point of the needle was next cleaned with alcohol, and passed through the flame. Finally the needle was inserted into the lower part of the left lung and the thin wire pushed forward. Afterwards the wire was pulled back, and the needle removed. In this way infection of the cutaneous and subcutaneous tissue was avoided.

The first tarabagan in the series received inhalation of an emulsion of the hepatized lung of the last guinea pig infected by lung puncture. Thereafter parts of the lungs from inhaled tarabagans and sisels were successively used for preparing the emulsions. Approximatively 1 c.c. of the organ was cut up into small pieces and shaken in 10 c.c. of sterile saline solution, until a pink emulsion was obtained. This liquid was then poured into a Paroleine atomiser (Burroughs Wellcome & Co.) similar to that used by Martini (21, 22) in his inhalation experiments. About 1—2 hours are usually required for preparing and spraying the emulsion.

(*b*) *Inhalation.*

We have considerably improved upon our previous methods. A specially-made wooden box is now used with a partition separating a small antechamber and the main compartment. The latter just accommodated one tarabagan. In the case of sisels, small rat cages were used and placed in the middle of the main compartment. The partition wall had an aperture situated at the level of the animal's head, just large enough for inserting the muzzle of a tarabagan or sisel. Facing this aperture is another slit in the outer wall of the antechamber through which the nozzle of the atomiser was introduced. The antechamber, prevents big drops of the spray from reaching the animal. Further the tarabagan is unable to bite the nozzle.

Diagram of a wooden box for experimental inhalation of tarabagans.



Before spraying, the animal is stirred up by slight thrusts with a blunt stick until it yelps. Then the spray is directed towards it. This moment is chosen, because forceful inspiration promotes the distribution of the spray into the smallest ramifications of the lower respiratory channel.

Early in the series the animals received inhalation for some time—up to one hour—and almost the whole of the emulsion was used. But it soon became evident that a very short period was sufficient. Finally only 40 compressions of the bulb were given, the manipulation lasting one minute, and less than one c.c. of the emulsion being used. After the spray the animal was kept for 5-10 minutes longer in the box so as to allow it to inhale the finest droplets suspended in the air.* All the tarabagans of group *B* were thus treated for only one minute.

After inhalation each animal was placed in a separate cage. Unfortunately many of the sisels, whether inoculated or not, fell into a dormant state, and succumbed soon afterwards. When killed, intestinal bacterias were frequently found in their internal organs, especially the liver. This kind of necrobiosis has been observed already by Schurupoff (26, 27) who experimented on the *Spermophilus guttatus* of Astrakhan. Mereshkovsky (23) had a similar experience with the Bessarabian sisel, and Jettmar (17) with the *Spermophilus dahuricus* from Transbaikalia. On the other hand, the Mukden marmot (*Sp. Mongolicus*), *Spermophilus Eversmani* from Transbaikalia (16) and the California Ground Squirrel (*Citellus Beecheyi* 7) proved suitable for laboratory purposes.

(c) *Killing.*

The following method was adopted : The animal was held by a pair of padded tongs. Then the skull was perforated by a sharp hook. The animal died almost immediately and no disturbing hæmorrhages into the respiratory tract occurred. The post mortem was performed immediately afterwards.

(*d*) *Bacteriological examination.*

The following technique was used to discover any bacteraemia in the earliest stages of the disease : blood was removed with a thick canula from the ventricle of the heart, while still slightly palpitating in most of the cases. 2—8 c.c. heartblood, obtained in this way, were divided among several test tubes containing bouillon or agar and incubated for several days or even weeks. Tests on guinea pigs were used in every case to identify the growing colonies.

(e) *Histology.*

For histological investigations pieces of the internal organs of every animal were fixed for a short time in formalin. The respiratory organs of the animals killed in the incubation period were preserved *in toto* in formalin. Then the lung was cut into pieces, every one of which was registered before embedding in paraffin, sketches of the shape being made. The embedded pieces were cut in the following way :

---

* Observations such as those of Lange and collaborators (19, 20) on white mice show that principally the finest droplets, suspended in air, lead to primary infection of the lung. According to Buchner, Martini, B. Lange and others, an atomiser may produce droplets with a diameter of 2-8 microns. Such droplets remain suspended in the air up to six hours (Gotschlich 9).

The first sections of each block were carefully investigated. If pathologic changes were seen, serial sections were made of the whole piece. If not, 100-200 microns of the pieces were sliced off and the new surfaces were again investigated, and so on. Thus each piece could be completely searched for morbid features.

The upper respiratory tract was systematically examined in every case; the tonsils received particular attention.

Kossel's method of staining was adopted for the sections:

10 c.c. conc. aq. sol. Meth. Blue (Hoechst) is diluted in 100 c.c. distilled water.

To this, add 30 drops of sol. of Sod. Carbonate (cryst.). 6 c.c. of 1% aqueous Eosin A extra (Hoechst) is now gently added while shaking.

Formation of sedimentation must be prevented.

Solution must be prepared and filtered immediately before use.

Stain section in this solution for 10-30 m. Differentiate in dil. acetic acid (1 drop glacial in petri dishful of dist. water) until pink colour appears in parts.

Pass through 95, then absolute, alcohol until no more blue comes out. Pass through Xylol and mount in cedar wood oil.

By this method even under low magnification, the blue-violet coloured granules of the basophile cells frequently present in the lymphatic tissue of the tarabagan, could be differentiated from the dark-blue and bipolar plague bacilli. We proceed now to a :—

III. DESCRIPTION OF THE EXPERIMENTS.

Table I summaries the general results (Group A).

The above shows a mortality of 100% corresponding to the experiments performed in tarabagans by Wu, Chun and Pollitzer (39) who found all their inhaled animals succumbing to plague. As may be seen from the table and the findings mentioned later on, the length of exposure seems to have no influence either on the duration of the illness or on the character of the pathologic changes.

The long duration of the illness in the tarabagans No. 2, 6, 9, 12, and 13 is somewhat significant in connection with the primary pneumonic changes found. Similarly individual resistance seems to affect the results. Thus, the bigger among the tarabagans succumbed to the primary pneumonic form, while the smaller ones took a pulmonary aspect.

38% of the tarabagans (5 out of 13 animals) suffered from primary pneumonic plague; the percentage among the sisels was approximately the same.

Every animal with clinical symptoms, even in the initial stage, showed bacteraemia. Smears and cultures were made from the following organs of every tarabagan :

1. mucus in trachea.
2. lung.
3. heart blood.
4. liver.
5. spleen.
6. gall bladder.

In every case positive bacteriological results were obtained from the lungs, blood, liver and spleen of the tarabagan. The smears of the mucus and gall bladder sometimes proved negative or doubtful, being often contaminated.

Smears from heart, liver, and kidneys of the sisels were mostly positive.

Table II supplies details of the macroscopical lesions found in the organs of plague inhaled animals (Group A.)

The histological lesions in the inhaled animals are as follows:—
Cervical Glands.

These are never severely affected. Tarabagans 3 and 10, sisels 5 and 2 showed a moderate swelling in the submaxillary lymph glands. In sisel 2 hyperaemia was noted in addition.

Fauces showed no marked lesions. Occasionally a few small haemorrhages were seen at the root of the tongue. Only once (Tarabagan 9) were larger haemorrhages noted in the mucous membrane of the nose.

Tonsils. In most of the cases they were not swollen but had a pale colour, with no haemorrhages. Big clusters of plague bacilli were often seen in the blood vessels. Here and there they abounded in the network of the lymphatic capillaries with increase of the polynuclear leucocytes. Occasionally small groups of plague bacilli were observed wandering through the intact epithelium of the crypts; they were never found in the lacunae.

Tarabagan 6 showed severe lesions, such as, large haemorrhages, infiltration of leucocytes, and masses of plague bacilli which had almost destroyed the normal structure of the tonsil. The haemorrhages extended at some places even to the surrounding connective tissue. Necroses were not observed in the tonsils, though they abounded in a tracheobronchial lymph gland, thus showing the primary lesion to be present in this gland and not in the tonsils.

Trachea. In almost every case, marked tracheitis was present. Large haemorrhages are common in the posterior wall of the trachea, especially in tarabagans. Frequently they pervade the whole substance. In some cases they extend only into the serosa. Large haemorrhages are often found at the bifurcation. The contents of the trachea consist of a sanguineous froth, containing blood corpuscles, desquamated eqithelial cells, a few leucocytes, and masses of bacteria. A gelatinous, frequently haemorrhagic oedema, between trachea and oesophagus and in the

mediastinum, was found in every tarabagan and sisel dead of pulmonary plague (except Tarb. I and Sisel I).

Albrecht & Ghon (1) consider this kind of oedema as typical of the primary bubo. Accordingly the glands enclosed in the oedema may be regarded as the primary bubo in inhalation plague.

Tracheal and Tracheo-bronchial Lymphatic Glands.

The deep tracheal or tracheobronchial glands showed in every case most severe changes. Often they were literally embedded in haemorrhages, and it was quite impossible to distinguish them from their surroundings. The microscopical lesions were not less marked, such as intense destructive haemorrhages, dense infiltration of polynuclear leucocytes and plague bacilli in the tissue of the lymphatic gland and the neighbourhood, and necrotic foci.

The small accumulations of lymphatic tissue around the main bronchi were often entirely invaded by plague bacilli. In such cases the polynuclear leucocytes numbered more than the lymphocytes.

Bifurcation of Trachea and Main Bronchi.

It has already been mentioned that the bifurcation of the trachea frequently shows severe haemorrhages. As a rule these are found in the posterior wall of the trachea and bronchi where the cartilage is absent. Here they reach beneath the epithelium of the respiratory tract, and surround the big blood vessels. The coat of the veins is practically destroyed, and often shows signs of hyaline degeneration, while the arteries suffer less severe changes. Big, compact masses of bacteria are found in these haemorrhages as well as in the lymph follicles of the posterior wall. Plague bacilli are interspersed everywhere in the haemorrhages, sometimes entering the lumen of the vein. The epithelium of the bronchi is affected likewise by these organisms. Smaller and larger groups of bacilli also invade the submucosa, where they form masses especially around a small blood vessel. The epithelium is loosened at these spots, while the bacillar masses proceed to the lumen of the bronchi. A similar process has been reported by Fujinami & Wu Lien Teh in human plague (8). Sometimes bacilli are found in the basal cells of the epithelium, accompanied by a few leucocytes or lymphocytes. The organisms have apparently emigrated either from the submucosa, or directly from the contents of the bronchus.

Lungs. Here a distinction must be made regarding the type of plague from which the animal suffers. In the case of 'septicemic' or better *pulmonary* plague, the capillaries are filled with plague bacilli, which may outnumber those found in the larger blood vessels. This was especially marked in sisel 9, killed in the dormant state 46 hours after inhalation. In some instances the capillaries are dilated, and contain numerous polynuclear leucocytes. They may even be entirely blocked by bacteria for a long distance. Hyaline degeneration of the walls is found very often in such areas followed not seldom by hyaline obturation of the lumen. (Tarabagan 1, 7, 8, 10, 11, Sisel 2, 4, 6).

The walls of the alveoli are thickened, and infiltrated with leucocytes and red corpuscles. Sometimes slight hyaline degeneration is observed, especially beneath the pleura (Tarabagan 8, Sisel 2, 3, 9.). As a rule, these changes are more marked in sisels.

Collapsed *alveoli* are sometimes met with near the big bronchi and blood vessels. The epithelium of the alveoli is much swollen with slight desquamation of the cells. These latter show badly stained nuclei, and vacuolisation of the protoplasm; sometimes they contain blood pigment (sisel 2 and 4). As a rule, the lumen of the alveoli is empty. Some haemorrhage occurs in T I, and sisel 1, 2 and 3. The alveoli under the pleura are filled with a serous exudate, in which many plague bacilli are suspended. Similar changes may be found in subcutaneously infected tarabagans as well, and thus are not characteristic of a pulmonary infection. Such exudate is sometimes observed in other parts of the lungs, usually in alveoli situated near the larger bronchi (Tarb. 7, 10) where plague bacilli agglomerate. The number of desquamated epithelial cells may be increased, but not the leucocytes. In a number of cases the bacilli suspended in the exudate have multiplied so quickly as to fill up the whole lumen of the alveolus. This may be followed by a secondary infiltration of leucocytes. In this way small pneumonic patches develop under the pleura, and also along the bronchi. (Sisel 2, 3, 5. Compare the findings in pneumonic plague).

The Bronchioli (*small bronchi*) in Pulmonary Plague show the same lesions as the larger branches. A condition of acute inflammation exists surrounded by haemorrhages extending to the smallest ramifications. Compact bacillar masses are found in these haemorrhages. Similar changes are seen around the blood vessels of the lung and may extend as far as the precapillaries (interalveolar). See Tarb. 1, 7, 10, Sisel 2, 4. In other instances the perivascular spaces are considerably dilated, and filled with a granular or filiform exudate, enclosing numerous plague bacilli as well as some leucocytes, and red corpuscles. Wu and Lin (34) found similar changes in naturally infected tarabagans. This infiltration of the plague bacilli around the blood vessels is in some animals very intensive. The *blood vessels* are surrounded by compact masses of bacilli, lying at first in the adventitia and later on infiltrating the walls of the vessels. (Tarb. 1, 3, Sisel 4, 6.). In such cases swelling and proliferation of the endothelial cells are observed. These bacillar clumps are extraordinarily large in Tarb. 7 and 8, where the diameter measures twice that of the blood vessel. The bacillar masses approach the blood vessels as far as the precapillaries. The above changes have not been noted in other organs of the same animals. The lung vessels of tarabagans 7 and 8 contain a comparatively small number of organisms with no bacillar thrombi inside. In tarabagan 1, 5 and 10, also sisel 2 and 4 such thrombi are encountered even in large blood vessels. The *lymph-vessels* are much dilated and blocked with plague bacilli, so that in stained specimens they may appear to the naked eye as prominent dark-blue spots. Haemorrhages may also occur around.

Primary Pneumonic Plague.

Wu & Eberson (40) and Wu, Chun & Pollitzer (39) have reported that the lesions found in the primary pneumonic plague of arctomyidae correspond to those observed in man. The microscopic changes in the animals dealt with in this paper differ likewise in no material way from those already described in human pneumonic plague.*

Sisel 7, however, has to be mentioned here. This animal was killed on the third day after inhalation, and showed almost no symptoms of illness. Post mortem revealed 50-100 partly confluent pneumonic patches of different sizes throughout the lung. The smaller ones especially displayed the same features as those already mentioned in cases of pulmonary plague. The alveoli showed numerous leucocytes, plague bacilli and debris. Hyaline degeneration of the alveolar walls was seen. In the capillaries plague germs were rarely detected; in the spleen they were also seen with difficulty.

No haemorrhages with groups of B. pestis were observed at the bifurcatio tracheae or in the walls of the larger bronchi.

The following paragraphs apply to both Pulmonary and Primary Pneumonic Plague.

Pleura.

In pulmonary cases with no pneumonic patches the pleura is almost unchanged. Sometimes the epithelial cells are swollen and lifted up by a small haemorrhage. Here and there circumscribed pleurisy and crowds of plague bacilli are seen, invading the pleura from small secondary pneumonic patches lying beneath. In sisel 3 these invasions are very numerous and extensive.

In animals affected with primary pneumonic plague a fibrinous pleurisy is always found over the surface of the inflamed lobes. Small necroses caused by invasion of bacillar clumps from the lungs are frequent in such cases.

Aorta and Blood vessels on the Hilus pulmonum.

The adventitia shows frequently extensive haemorrhages and clumps of bacilli. The media of the larger veins is often torn asunder by haemorrhages, but the walls of the arteries, particularly of the aorta, show only hyperaemia, sometimes slight extravasation, and isolated groups of B. pestis.

Heart.

Haemorrhages were often seen in the muscular layer of the heart, leading sometimes to necrosis of the muscular fibres. In other cases haemorrhagic stripes, densely infiltrated with plague bacilli, separate

* The microscopic lesions in the pneumonic foci of guinea pigs infected by lung puncture conform in the main to those found in the primary pneumonic foci of the inhaled arctomyidae.

the degenerated muscular fibres from one another. Even where haemorrhages have not occurred the bundles are loosened by the dilated capillaries. In the perivascular spaces of the capillaries crowds of plague bacilli are found, such changes being most marked in Tarb. 7 and 8.

Spleen. This shows in a few cases necrosis, (Tarb. 9, 10). As a rule there is only hyperaemia with all the features of an acute plague tumour.

Liver. In most of the cases acute congestion is seen. The cellular trabeculae are reduced in some areas, while in others abundant fat droplets and blood pigment inside the liver cells are observed. Sometimes small haemorrhages, followed by slight necrosis of the liver cells occur.

Plague bacilli are abundant in the capillaries and haemorrhages. Frequently the cells of the capillary endothelium show phagocytosis, but the bacilli seemed rather to propagate than to perish in them.

Kidney. The common features are hyperaemia, small haemorrhages and slight degeneration of the epithelium. Here and there small necroses were to be seen originating from the haemorrhages or from a capillary vessel, blocked with plague bacilli.

Alimentary Tract. The intestine often shows haemorrhages of various size. The large ones are situated in the serosa, rarely in the submucosa, and harbour numerous clumps of plague bacilli. The villous coat is only slightly changed. In some cases the capillaries are enlarged and filled with plague bacilli, some being encountered in the surroundings. Occasionally the epithelium is slightly desquamated and some red corpuscles or plague bacilli may be seen wandering through its intact layer. Sometimes larger haemorrhages into the lumen are observed. The lymph-follicles show no marked changes, but the lymph-capillaries may be filled with bacilli. In such cases the mesenteric glands are inflamed as well. In no case, however, do they show severe lesions or the characteristic features of a primary bubo.

GROUP B: *Inhaled tarabagans, killed at varying intervals after inhalation before appearance of marked symptoms.*

Table IV supplies the details of the inhaled animals as well as morbid changes found at P.M.

This table demonstrates macroscopically the gradual development of pathologic changes. These begin with typical gelatinous oedema on the posterior wall of the lower portion of the trachea and marked swelling of the tracheal or tracheo-bronchial lymph glands. Soon afterwards hyperaemia and catarrhal symptoms of the mucous membrane of the trachea may be observed as well as hyperaemia of the lungs and beginning congestion of the spleen.

The tests on guinea pigs with material from different organs and with cultures from the heart blood produced some remarkable results. Thus :

(a) Although 9 guinea pigs were inoculated with material taken from tarabagan I (killed 24 hours after inhalation), none fell sick. This material was taken from :

i. The soft and hard palate	inoculated	intracut.
ii. The nasal cavity	,,	,,
iii. The contents of duodenum	,,	,,
iv. The blood of the left ventricle	,,	subcutan.
v. An emulsion of max. lymph. gland ...	,,	,,
vi. An emulsion of right tonsil	,,	,,
vii. An emulsion of mesenteric gland	,,	,,
viii. An emulsion of right hilus pulmonum	,,	,,
ix. An emulsion of apex of right lung ...	,,	,,

(b) Guinea pigs inoculated with material from the trachea of tarabagan 2 (killed 30 hours after inhalation) likewise showed negative results.

(c) A guinea pig, infected subcutaneously with cultures from the heart blood of tarabagan 6 fell ill with plague but *survived for 11 days*, showing extensive suppuration of inguinal buboes and secondary pneumonia. Apparently, the bacilli were considerably weakened. On the other hand, plague bacilli cultivated from tarb. 7 (killed 72 hours after inhalation) proved fully virulent, for they killed guinea pigs promptly in 4-6 days with acute bubonic symptoms.

These facts seem to prove either (a) that the germs had entirely disappeared from the upper respiratory tract, perhaps even from the tested parts of the lung, or (b) that the plague bacillus had been weakened by the protective powers of the tarabagan. Thus they were unable to further infect guinea pigs intracutaneously or subcutaneously. The later explanation appears more plausible.

These observations correspond to the results of authors performing inhaling experiments with different kinds of bacteria (Lange, Keschischian, Novosselsky, etc.), who found that germs perish quickly after inhalation or become much weakened temporarily with changes in their antigenic qualities.

HISTOLOGICAL FINDINGS IN GROUP B.

The study of the histological lesions found in these killed animals helps to elucidate to a certain degree the development of plague infection in arctomyidae. Tarabagan 1 and 2 (killed 24 and 30 hours after inhalation) showed no histological changes at all, except perhaps slight hyperaemia in the lung capillaries.

The first marked changes were found *in Tarabagan 3* (killed 42 hours after inhalation). The histological features were present exclusively in the parenchyma of the lung; other organs including the upper respiratory tract remaining unchanged. No plague bacilli could be detected in the tonsils, trachea, main bronchi, or mediastinal lymph glands.

The pathological changes in the lungs apparently originated from two small foci, namely :

(a) *The first focus* consists of a small bronchial lymph gland adjoining a bronchus with diameter of 0.3 mm situated in the lung parenchyma distant approximately 6 mm from the left hilus.

Sections from the centre of this small focus show the following histological details :

The big *bronchus* has an unchanged mucous coat except where the upper-mentioned lymph gland borders. Here the mucosa and submucosa are completely infiltrated with leucocytes and nuclear debris. The normal structure of the tissue has disappeared, so that no boundary can be seen between the mucosa and the lymph gland. The epithelium is swollen, and immediately under it groups of B. pestis may be seen.

The lumen of the bronchus however has no pathological contents and plague bacilli are absent.

The lymph node itself is much enlarged and densely infiltrated with leucocytes and debris. Prominent groups of plague bacilli abound in the centre of the gland which is surrounded almost everywhere by haemorrhages partly filling the lumina of the neighbouring alveoli.

The bronchus is accompanied by a big vein, containing many leucocytes in its lumen, while the endothelium undergoes early desquamation. Some leucocytes are seen wandering through the wall of this blood vessel. The lymph spaces in the adventitia are much enlarged and filled with serum containing lymph cells.

The neighborhood of the focus in the left lung presents mainly changes in the blood vessels and lymphatics, while the respiratory system is almost unaffected. Here and there groups of collapsed alveoli alternate with emphysematous spots; occasionally a condition of hyperaemia is observed. The walls of the bigger blood vessels are frequently loose and interspersed with leucocytes. Ofter the endothelium is desquamated.

The dilated lymphspaces and lymphatics of the adventitia form not seldom a broad ring around the blood vessel. These rings are characteristic features of the early stage of the disease. The lymph nodules in this area show often proliferation, and are invaded by pus cells. They also harbour numerous pigment cells, but plague bacilli were absent. Here and there the precapillaries are almost blocked by accumulations of polynuclear cells.

(b) *The second focus* is situated in the centre of the right middle lobe among the alveoli. Though numerous sections were made, no direct connection with any bronchiole could be found.

The focus has a diameter of about 200 microns and consists of a small number of collapsed alveoli surrounded by an emphysematous area. Besides the elements of the alveolar walls there are in the focus numer-

ous polynuclear leucocytes, nuclear debris and a central dense cluster of plague bacilli. The original structure of the tissue has almost disappeared.

The alveoli situated between this focus and a neighboring bronchus are somewhat collapsed and hyperaemic. Their capillaries and precapillaries contain numerous polynuclear leucocytes.

The bigger blood vessels of this area show enlarged lymph-spaces filled with serum, but no increase of lymph cells.

The whole of the right middle lobe is similarly changed with atelectases, hyperaemia of the alveoli, accumulations of polynuclears in the precapillaries, enlarged lymphspaces in the adventitia of bigger blood vessels containing an increased number of white corpuscles.

The other lobes of the lungs proved to be free from the above changes. The haemorrhages in the alveolar tissue beneath the pleura (mentioned in Table IV) display no changes suggesting the development of a plague focus.

In the lungs of the Tarabagan 4 (killed 45 hours after inhalation) plague bacilli could not be identified with certainty. In some parts of the left upper lobe and of a small right median lobe, however, marked histological changes were observed suggesting the invasion of B. pestis. In these areas emphysematous spots alternated with collapsed alveoli. The latter showed pathological changes, such as infiltration of alveolar walls, their capillaries and precapillaries by polynuclears, the last being sometimes blocked. At some places, usually in the middle part of a collapsed area, the leucocytic infiltration is so dense that the pressed alveoli form an irregular shaped nodule with destroyed nuclei in the centre. Probably these nodules represent the early stage of such a plague focus as described in tarabagan No. 3. Plague bacilli, however, could so far not be demonstrated in these areas. Some of the bigger blood vessels surrounding such areas contain an apparently increased number of white blood elements.

A bronchus, situated near one of the above mentioned nodules, shows early infiltration of the adventitia with polynuclears as well as numerous eosinophile cells. At one spot the infiltration has already penetrated the mucosa, and early nuclear degeneration is observed. The accompanying vein has enlarged lymph spaces containing fluid and an increased number of lymphocytes.

The remaining parts of the respiratory tract displayed no changes. In the tonsils was seen a condition of hyperaemia in the subepithelial layer, but the epithelium was intact and plague bacilli were absent.

The epithelium of the trachea shows at places permeation of small groups of erythrocytes into the lumen. The outer layer, especially the lymph nodules on the posterior wall, seems unchanged. The tracheobronchial lymph glands are hyperaemic, but not infiltrated with leucocytes or plague bacilli. In both spleen and liver no unusual changes were observed.

Tarabagan 5 (killed 54 hours after inhalation) showed already some plague foci in different parts of the lung. These are right lower lobe, right middle lobe and right median lobe. No changes were seen in the entire left lung or other lobes of the right lung.* The largest accumulation of B. pestis was found in some small bronchial lymph glands situated at the bifurcation of two small bronchi. On the whole these foci demonstrate the same histological features as the lymph gland in Tarabagan 3. In some of these, however, the changes noted were more advanced, as testified by thicker crowds of bacilli invading the wall of the adjoining bronchus on a higher scale, and also wandering through the epithelial layer. Likewise they penetrate the infiltrated adventitia and media of the neighbouring veins, but are not found in the intima. In some parts near the affected lymph node small groups of plague bacilli were found in the lumen of the bronchus, mixed with polynuclear leucocytes. Some alveoli in the immediate neighbourhood of the affected lymphglands are collapsed. In a few, desquamated alveolar cells, polynuclears as well as numerous plague bacilli were found. When nuclear decay was present in such areas, it was rarely possible to find the proper limits of the lymphgland.

The lung district belonging to such an affected gland shows enlarged lymph spaces around the blood vessels as far as the precapillaries. These lymphspaces contain a homogeneous fluid, in which an increased number of lymphocytes and polynuclears are suspended mixed with a few plague bacilli. The alveoli of such areas are partly emphysematous and hyperaemic. In some places isolated red corpuscles wander through the walls into the lumen of the alveoli.

The histological changes in the lungs of Tarabagan 6 (killed after 52 hours) differ in no material way from those found in the previous ones.

The main difference lies in the fact that bacteraemia has taken place already. Serial sections of the most affected lymphgland reveal invasion of plague bacilli into a lung vein.

The following histological features are observed :

The lymph gland situated amidst several bronchioles is much enlarged. Masses of polynuclears and nuclear debris have entirely destroyed the original structure of the tissue. This gland communicates by large infiltrated lymph ways with the neighbouring nodules, which are likewise severely affected. The lymphgland is filled with plague bacilli wandering in continuous masses through the loose bronchial epithelium. The lumen of the bronchus contains clumps of plague bacilli mixed with numerous polynuclears.

The whole lymphgland is interspersed and surrounded by haemorrhages.

---

* The right lung of the Tarabagan has two posterior median lobes attached to the right main bronchus, besides the usual three lobes.

The walls of a big lung vein, enclosed in the proliferated lymph gland, ar loosened and densely infiltrated with leucocytes and red corpuscles. At some spots they are torn asunder including the elastic coat. The intima is much thickened by leucocytic infiltration. The endothelium is swollen and desquamated. In many parts this is absent, thus allowing plague bacilli to enter the lumen of the vessel, where single organisms surrounded by endothelial cells and leucocytes are seen.

Following the more advanced process in the lungs, the tracheo-bronchial lymph glands and the lower tracheal glands are much affected. Some of these are enlarged, showing proliferation of their cells and marked infiltration with decaying polynuclear leucocytes. In some parts many plague bacilli are observed, showing by their pair-like dispositions a condition of highly active growth.

The trachea bears signs of a slight catarrh, but the epithelium is intact, and advanced changes in the walls are not observed. The lymphatic tissue on the posterior wall of the lower trachea shows slight proliferation and infiltration by polynuclears. Here plague bacilli in moderate numbers are seen. In the upper part of the trachea no pathological changes are noticed in the lymphatic nodules, nor are plague bacilli encountered.

The tonsils show no unusual changes, and plague bacilli are absent. All other organs are unchanged with the exception of the spleen. Here the characteristics of an early acute plague tumour are evident.

In tarabagan 7 the pathologic changes are still more developed, and similar to those decribed in advanced pulmonary cases.

Spacious exudate rings around the blood vessels, desquamation of the endothelial layer, severe catarrh in the air passages containing big clusters of plague bacilli, suppuration of the lymphatic nodules with extension of the process to the neighbouring alveoli are the main features. In the upper respiratory tract marked changes are seen such as have been described already in advanced cases.

VI. DISCUSSION.

SUMMARY AND CONCLUSIONS.

The histological findings based upon a systematic study of over 4000 sections obtained from 20 tarabagans and 9 sisels tend to show that the B. pestis invades the intact wall of the lower respiratory tract, thus causing infection and death of the animals.

Primary buboes were always found among the bronchial and tracheo-bronchial lymph glands—macroscopically characterised by considerable swelling, haemorrhages and a gelatinous sanguineous oedema. The naso-pharynx, conjunctiva and alimentary canal never revealed primary lesions nor offered such features as those described by Schurupoff[26]. This author inoculated plague bacilli either on the conjunctiva or nasal mucous membrane in three series of *Sp. guttatus*, and fed another lot with infected material. He found enlarged submaxillary and postauricular

lymphglands with infiltration of the surrounding tissues. Besides, all his sisels inoculated on the mucous membrane showed a bloody secretion from their nostrils containing B. pestis in almost pure culture, while those infected orally sometimes developed bloody diarrhoea.

Our inhaled animals did not show any of the above features. Though the tonsils were thoroughly examined in every case, only one pair was affected. But even here there were more marked primary changes in the lungs.

Although the major air-channels, such as, larynx, trachea and main bronchi, showed most severe lesions in advanced cases, primary foci were never observed in them in the early stages of the disease, notwithstanding the fact that the lung tissue had already displayed distinct morbid changes. These findings do not speak for a primary infection of the big air passages.

Of course, most of the inhaled bacilli, especially those suspended in the larger droplets, are retained by the walls of the tracheo-bronchial ramifications. It seems, however, that the organisms are quickly ejected, weakened or killed *in situ*. This view is supported by the fact that the presence of plague bacilli cannot be ascertained either by histological or animal tests until two days have passed after inhalation.

Nevertheless, it must be mentioned that the *secondary* changes in the trachea and main bronchi begin at quite an early period. On one hand, plague bacilli rapidly propagate in the lymph nodules or lymphglands near the large bronchi, and enter the lumen of the latter. On the other, clumps of pus and epithelial cells, containing masses of B. pestis, are carried away from the foci of the deeper respiratory tract to the major air-passages along with the products of secretion.

With regard to the *smaller bronchi*, it may be possible for a primary infection to be localised in them. Microscopical findings in Tarab. 5 and 6 (Group B) seem to support this contention. Furthermore, it appears as if the inhaled bacilli had penetrated primarily the mucous membrane of the bronchus adjoining the affected lymphgland. A similar mode of infection was suggested by Birch-Hirschfeld (Deutsches Archiv. f. klin. Med.) and Abrikossow (Virch. Arch. Bd. 178. 1904) for primary localisation of the tubercle bacillus in the lungs. These authors found among other things primary localisation in the mucous membrane of a middle-sized bronchus in the apex of a lung.

The presence of plague bacilli in the different lymph vessels may possibly be caused by congestion and reversion of the lymph stream. Two facts, however, are against this view :

(a) In a still earlier stage (Tarab 3), only the centre of the lymphgland and the region of the different lymphatics are affected, while other parts, especially those bordering the mucous membrane of the bronchus, seem to escape.

(b) The epithelium of the bronchus is affected only in one region corresponding to the centre of the lymphgland. Plague bacilli are not likely to have invaded the gland exactly and exclusively at this point.

Excluding the above-mentioned possibilities, we believe that the deeper parts of the respiratory tract, namely, the *bronchioli respiratorii* (infundibula) and the alveoli, are the most likely spots for the final entrance of the invading organisms.

It may seem strange that the inhaled droplets carrying plague bacilli can wander directly through the sinuous bronchial ramifications to the alveoli without being arrested by their walls. It has to be remembered, however, that numerous exceedingly small droplets with a diameter of only some microns are produced by the atomiser. Earlier experiments with various bacteria have proved that such droplets may be suspended in the air for several hours, and may also penetrate the alveoli (Arnold,[2] Buchner,[6] Hildebrandt,[15] Nenninger,[24] Paul,[25]). Under such circumstances, Langer and colleagues, Griffith,[11] etc., believe that the smallest droplets are responsible for infection in inhaled rodents.

Moreover, it has been ascertained that the undamaged walls of the alveoli may be traversed by bacteria; also that small particles of coal dust, dead bacteria, etc., are able to wander through the intact alveolar epithelium—to be found shortly after inhalation in the alveolar lymph spaces, lymphatics and bronchial lymphglands (Lange and Keschischian[19]).

Our findings of animals killed in the early stages indicate that plague infection apparently occurs in the area of the alveoli in two ways :

(a) *More common mode.* The inhaled droplets conveying plague bacilli enter the lymphspaces (Saftkanalsystem) of the alveolar walls through a gap between their epithelial cells and produce the first changes on their way to the bronchial gland, as has been described in Tarab 5 and 6 (Group B). It is interesting to find the plague bacilli in these lymph spaces rather evenly distributed, and only on rare occasions arranged in small groups. It seems as if the respiratory movement promoting the flow of the lymph stream assists the spread of the bacteria evenly. This method of infection displays no obvious lesion of the alveolar wall at the site of entry.

It has been known for some time that plague bacilli can wander through the intact skin and not produce any local pathological changes. In the same way they are probably capable of passing through the alveolar epithelium.

In 1888, Cornet made similar statements regarding the action of the tubercle bacillus (Wiener Med. Wochenschr.), which were confirmed by other workers, such as, Behring, Calmette, Orth, etc. Thus

plague inhalation in arctomyidae at least may likewise be interpreted mainly as a *cryptogeneous infection.*

There is still another analogy between the mode of infection in inhalation plague and tuberculosis. As has been mentioned, the mediastinal lymphglands of Tarab 4 and 5 of Group B (killed in an early stage of the disease) were markedly enlarged. In T 5 especially these glands could even be *macroscopically* recognised by the encircling gelatinous haemorrhagic oedema. Microscopically, they showed evident proliferation of the lymph tissue and infiltration with polynuclears. No plague bacilli were, however, visible in hundreds of serial sections made.

Similar observations are reported by Herring and MacNaughten (Lancet, 1922, I) when experimenting with B. tuberc. subcutaneously upon guineapigs. It seems therefore that in both cases the soluble toxin of the bacilli first enters the lymphglands and prepares them, though ineffectively, for the fight against the incoming organisms. Though there are essential analogies between the mode of infection in inhalation plague and inhalation tuberculosis, an important difference lies in the fact that tubercle bacilli are carried away in the lymph stream by phagocytic cells, while plague bacilli are freely suspended in the fluid of the dilated lymph spaces, exudate cells never enclosing them.*

(b) *Less common mode.* The pathological changes observed here in the alveoli cannot be so satisfactorily explained as in mode a. Some collapsed areas in the lung tissue are infiltrated with many pus cells and contain crowds of plague bacilli. These foci increase in size, lead to hepatisation of other parts of the alveolar tissue, and finally lobular pneumonia.

Two more questions remain to be discussed :

(i). How does hepatisation of lung areas in arctomyidae occur? In primary pneumonic plague this apparently starts in the majority of cases from the above-mentioned alveolar atelectases as a result of primary localisation of the B. pestis from the droplets. In other instances they may arise from a severely affected bronchial lymphgland, and then the process involves the neighboring alveoli through emigration of leucocytes and plague bacilli (Tarab 6 and 7 Group B, and several tarabagans and sisels of Group A).

In advanced pulmonary cases, secondary pneumonic foci may develop under the pleura, as already mentioned under Group A; here the alveoli are filled with a serous fluid in which plague bacilli are suspended.

---

* Primary plague pneumonia in arctomyidae shows also no phagocytosis of B. pestis by alveolar or dust cells, though sometimes observed in human cases (Strong,[32] Wu and Woodhead,[42] Fujinami and Wu,[8] etc.) and frequently in the early stages of the disease (Jettmar[14]).

(ii). How does the septicemia originate?

The lung veins with their thin walls, situated in the immediate neighborhood of an infected lymphatic nodule, are much exposed and evidently allow B. pestis at a very early stage of the infection to enter the lumen of the vessel (Tarab 6 Group B). About the same time several lymphatic glands, communicating with the main lymph channels are already attacked; an influx of the infected lymph into the blood stream follows as a sequence.

While trying to apply our knowledge as gathered from those experiments upon tarabagans and sisels, two aspects may be emphasised. I. From our studies of the 1920-21 human outbreak in Manchuria (38, 39) we came to the conclusion that besides manifest pneumonic plague, there was a group of cases designated as *pulmonary* met with mostly towards the end of the epidemic. Other workers have previously observed such cases but have merely called them 'septicemic' without realising perhaps their true significance. Our present experimental observations have, we hope, materially contributed to a knowledge of this type of respiratory infection.

II. In an elaborate report by Kulescha (1915)[18] he proposed, for further support of his theory of tonsillar infection in pneumonic plague, that systematic animal experiments should be made to ascertain the true mode of entry of the infecting organism. Our extensive series of investigations may be said to have fitted in with his desires, but they have produced exactly the opposite results that Kulescha expected. In other words, we are more convinced than ever that infection in plague pneumonia is not a faucial, or even a tracheal, one, but essentially an invasion of the deeper portions of the respiratory tract.

WU LIEN TEH

and

H. M. JETTMAR.

TABLE I.

(List of Animals of under Group A.)

a. TARABAGANS.

No.	Size:	How long inhaled?	Inhaled with:	Sleeping?	Killed? Died?	Survived after infection.	Type plague.
1	Big	1 hour	Emuls. lung from gp.	No	Died	under 4 days	Pulm.
2	,,	30 min.	,, ,, tarab. 1	,,	Killed when dying	9 ,,	Pneum.
3	Small	,, ,,	,, ,, ,, ,,	,,	Died	over 3 ,,	Pulm.
4	Med.	,, ,,	,, ,, ,, ,,	,,	,,	4 ,,	,,
5	Small	25 ,,	,, ,, ,, 2	,,	,,	3 ,,	,,
6	Big	,, ,,	,, ,, ,, ,,	,,	Killed when dying	6 ,,	Pneum.
7	Med.	15 ,,	,, ,, ,, 6	,,	Died	3 ,,	Pulm.
8	,,	,, ,,	,, ,, ,, ,,	,,	Killed when dying	3 ,,	,,
9	Big	2 ,,	,, ,, ,, 7	,,	Died	7 ,,	Pneum.
10	,,	1 ,,	,, ,, ,, ,,	,,	,,	over 3 ,,	Pulm.
11	Small	,, ,,	,, ,, ,, 9	,,	,,	,, 3 ,,	,,
12	Med.	,, ,,	,, ,, from gp.	,,	,,	under 6 ,,	Pneum.
13	Big	,, ,,	,, ,, ,, ,,	,,	,,	,, 5 ,,	,,

b. SISELS.

No.	Size:	How long inhaled?	Inhaled with:	Sleeping?	Killed? Died?	Survived after infection.	Type plague.
1	250g	5 min.	Cult. lung tarab. II	No	Died	under 4 days	Pulm.
2	220g	,, ,,	,, ,, ,, ,,	,,	,,	,, 4 ,,	,,
3	210g	,, ,,	,, ,, ,, ,,	,,	,,	,, 4 ,,	,,
4	250g	,, ,,	Emuls. lung sisels 2 & 3	,,	Killed when dying	4 ,,	,,
5	220g	2 ,,	,, ,, ,, ,, ,,	,,	Died	under 4 ,,	,, Pneum. incip.
6	210g	,, ,,	,, ,, ,, ,, ,,	12 hrs.	,,	,, 5 ,,	,, ,, ,,
7	210g	,, ,,	,, ,, ,, ,, ,,	No	Killed before any signs of illness	,, 3 ,,	Pneum.
8	200g	,, ,,	,, ,, ,, ,, ,,	12 hrs.	Died	,, 5 ,,	,,
9	260g	,, ,,	Trach. mucus sisel 9	24 ,,	Killed in dormant state	46 hours	Pulm.

TABLE II.

Showing macroscopic changes in inhaled tarabagans.

No.	Path. changes in ext. lymph. glds.	Tonsils & fauces	Trachea:	Tracheal and tr.—bronchial glds.:	Lungs and Pleura:	Spleen:	Other organs:
1.	No	Small haem. in tons. angle.	Tracheitis, large haem. at bifurc.		No pneum.; lower lobes cong. Haem. in walls of lung-veins.	Acute sw.	Cort. haem. in kidneys.
2.	No	No marked ch.	Tracheitis.	Trach.—br. gds. enl., dark-red.	Numer. confl. pneum. foci of greyish colour, with red periphery, esp. in lower lobes. Fibrin. pleuritis.	Twice norm.	Pericard. with fibrin.-sanguin. exudate. Adhesions.
3.	One submax. lymph-gl. sw.	Small haem. on tons.	Tracheitis. In cent. port. and bifurc. extens. haem. Haem. oedema bet. oes. and trach.	Trach. glds. hyperaem., sw., gland on arc. aortae hyperaem. and sw.	All lobes cont. air; sections covered with haem. froth.	Small, pale.	Haem. in walls of arcus aortae; liver enl. Mesent. glds. dark-red. Haem. in walls of alim. tract.
4.	No	No marked ch.	Tracheitis. In cent. port. and bifurc. diffuse haem. Haem. oedema bet. oes. and trach.	Embedded in haemorrhages.	All lobes cont. air; no pathol. changes.	1½ enl.	Mesent. glds. enl., dark-red.
5.	No	No marked ch.	Spotted haem. in cent. port. Haem. oedema bet. oes. and trach.	Glds. enl., dark-red.	All lobes cont. air.	Hyperaem.	Haem. in walls of the alim. tract; mesent. glds. sl. enl.

TABLE II.—*Continued.*

6.	No	Base tongue pale. Tons. enl., oedem., dark-red.	Epigl. free, haem. on vocal cords, big haem. at bifurc. trach.	Trach. glds. not markedly ch., lymph gl. on the arc. aortae embedded in haem. sw.	In lt. upper lobe two lobul. foci of hazelnut-size; in lt. lower lobe one. Rt. lung extensive hepatis. Rt. pleuritis with punctif. necros.	Hyperaem.	Haem. in myocard.
7.	No	No marked ch.	Much haem., esp. on post. wall. Tracheitis Haem. oed. bet. oes. and trach.		Haem. along big bronchi, all lobes cont. air.	Hyperaem., sl. enl.	Mesent. glds. dark-red, sl. enl. Punctiform haem. in walls small intest.
8.	No	No marked ch.	Haem. in larynx and trach., esp. on post. wall. Haem. oed. bet. oes. and trach.	Embedded in haem.	All lobes cont. air.	Small, pale.	Haem. in walls of aorta and myocard. Liver chocolate stained.
9.	No	Haem. on muc. memb. of nose; tons. not ch.	Haem. in larynx and along whole trach., esp. on the post. wall.	Dark-red, enl.	Partial fibrin. pleur. Confl. hepatis. in lt. lung, except apex and lower margin. In upper part of lt. lower lobe big hep. area.	Consid. incd., soft.	Extens. haem. at radix aortae and pulmon. veins. Haem. in myocard. and walls of the blad.
10.	Submax. lymph glds. enl. but pale; no haem.	Dark-red, sw., small haem.	Laryng. haem. In the cent. port. of trach. haem. Bet. oes. and trach. oed.	One gl. in centr. part of tr. mark. enl. On the V. cava black-red, very enl. gland.	Roots of lung dark-red; haem. around pulm. veins. All lobes cont. air.	Normal.	Haem. in the myocard. Duoden. muc. membr. detached. Intest. contents show gelat. pinkish colour.
11.	No	Fauces sl. haem. Tons. no mark. ch.	Larynx with punctif. haem.; haem. stripes along tr. On the post. wall haem. oed. Serious haem. at bifurc. trach.	Trach. glds. dark-red, enl., trach.—br. glds. surrounded by gelat. haem. oed., dark-red, enl.	All lobes cont. air; subpleural haem.	Normal.	Haem. in advent. aortae, myocard. and blad.
12.	No	No marked ch.	Spotted haem. esp. in post. wall.	Severe mediastinitis. Tr.—bronch. glds. sw., haem., dark-red.	Lt. lobes hepat. Rt. 1. lobe hep. focus; rt. m. lobe small foc. Partial fibr. pleur.	Much enl., dark-red.	Haem. in myocardium.
13.	No	No marked ch.	Ac. tracheitis.	Mediast. glds. sw.	Both lungs confl. hepatis. foci. Acute pleur.	Acute sw.	Haem. in small intest. Mesent. glds. sl. enl., dark-red. Haem. in myocard.

TABLE III.

Showing macroscopic changes in inhaled sisels.

No.	Path. changes in ext. lymph-glds	Tonsils & fauces:	Trachea & trach.-bronch. glands:	Lungs & Pleura:	Spleen:	Other organs:
1.	Subm. gl. dark-red, enl.	—	Hilus-glds. enl., hyperaem.	All lobes contain air.	—	No changes.
2.	—	—	Tr. gl. dark-red, enl. Haem. oedem. in mediast.	Lungs with hyperaem. streaks. Punctif. haem. in pl., small pn. patches. Pleuritis.	Acute sw.	Haem. in myocard., kidneys infl.
3.	—	—	Oedema of mediast., glds. enl.	Small pneum. patches. Pleuritis.	Acute sw.	Haem. in myocard. and the intest. serosa.
4.	—	—	Oedema of mediast. Glds. sw.	Pneum. patches size of pea.	—	Small intest. dark-red. Mes. glds. unchanged.
5.	Subm. lymph- gl. sl. enl.	—	Whole mediast. black-red. oedemat. mass.	All lobes pneum. confl. patches.		Dark-red masses in small intest. but no distinct haem. Mes. glds. unchanged.
6.	—	—	Oedema of mediast.; glds. sw.	All lobes contain air.	—	Like sisel 5.
7.	—	—	Colorless oedema bet. oes. and trach. Glds. sl. enl.	Some pleur. patches. Many confl. pneum. patches (50-100).	Acute sw.	No changes.
8.	—	—	Haem. in trach., mediast. glds. embed. in large haem.	Rt. lower lobe, and parts of lt. lung hepat. Pleuritis.	Acute sw.	Mesent. glds. sl. sw.
9.	—	—	—	—	—	Infl. of alim. tract.

TABLE IV. (Group II)
Showing Tarabagans Killed—at Varying Intervals After Inhalation.

No.	Size.	Inhaled with lung emulsion from	Killed after.	PATHOLOGICAL CHANGES IN. Cut. lymph. glands.	Tonsils	Trachea.	Tracheal and tracheobr. glands.	Lungs and pleura.	Spleen.	Other organs.	Heart blood	Tests on guinea pigs.
1.	Big	Tarb. 11	24h.	None	None	None	None	Some punctiform haem.	None	None	sterile	9 gps. inoc. cut. or subcut. with emuls. of different organs rem. healthy.
2.	Small	Tarb. 12	30h.	None	None	Muc.memb. sl. hyperaem.	None	None	None	None	sterile	Gp. inoc. with cult. from mucous memb. of trachea rem. healthy.
3.	Med.	Tarb. 13	42h.	None	None	None	None	6-8 small pleural haem. with diam. 1-1. 5mm.	None	None	sterile	not performed.
4.	Med.	Tarb. 13	45h.	None	None	None	None	None	None	None	sterile	not performed.
5.	Very big	Tarb. 13	51h.	None	None	None	Gelat. oedema between bifur. tracheae and aorta.	None	Slight hyperaemia	None	sterile	not performed.
6.	Med.	Tarb. 12	52h.	None	None	None	Trach - bronch. glands sl.enl., embedded in a gelat. oedema.	None	Slight enl hyperaemia	None	pos. (about 100 germs in 0.1. c.c.)	1 gp. inoc. subcut. with cultures from the heart-blood *died* after 11 days; P.M.: suppurated inguinal buboes, secondary pl. pneum.
7.	Big.	Tarb. 12	72h.	None	None	Small haem. around vocal cords. hyperaem. muc. memb. of tr.	Trach-br. glds. much swollen, dark-red embedded in a haem. oedema	Hyperaemic. One small haem. at periph. left upper lobe 7-10 punctiform suffusions on pleura.	Slight enl. hyperaemia	Muc. memb. of stomach and small intest. hyperaemic. Mesent. glands changed. Kidneys much congested.	abundant growth.	1 gp. inoc. with cultures from heart blood died after 6 days, 1 gp., inoc. with bact. cult. from lungs died after 4 days. *P.M.*: acute bubonic plague.

VIII. BIBLIOGRAPHY.

1. *ALBBECHT & GHON* Reports Austr. Pl. Commission 1898-1900.

2. *ARNOLD* quoted after GOTSCHLICH.

3. *BALLIN & HEYMANN* quoted after GOTSCHLICH.

4. *BRANCH & STILLMAN* Jl. Exp. Med. Vol. XL. pp. 743-752.

5. *BRANCH & STILLMAN* Jl. Exp. Med. Vol. XLI. pp. 631-638.

6. *BUCHNER* quoted after GOTSCHLICH.

7. *McCOY* Public Health Bull. No. 43, 1911.

8. *FUJINAMI & WU* Reports Manch. Pl. Prev. Service 1923/24.

9. *GOTSCHLICH* in KOLLE-WASSERMANN, Handb. d. path. Mikroorg. Bd. I, pp. 224-238, II. Aufl., 1911-13.

10. *GRAMATSCHIKOFF* Baumgartens Arbeiten aus dem Gebiete der pathol. Anatomie und Bakteriol. 1892, S. 1450.

11. *GRIFFITH F.* The Jl. Hyg. Vol. XXV, p. 1-10.

12. *HASSAN HAMDI* Zeitschr. f. Hyg. 1904, Bd. 48, p. 349.

13. *HILDFBRANDT* Beitr. z. path. Anat. u. Physiol. Bd. 2, p. 411.

14. *JETTMAR* Arch. f. Schiffs-u. Tropenhyg. 1925, Bd. 29 p. 650.

15. *JETTMAR* Zeitschr. f. Hyg. Bd. 97 p. 322, 1923.

16. *JETTMAR* Zeitschr. f. Hyg. Bd. 104, p. 551. 1925.

17. *JETTMAR* Jrl. Transbaik. Med. Ass. 1922, No. 1-3.

18. *KULESCHA* in ZABOLOTNY: Russian Plague Report 1915, T. II.

19. *LANGE & KESCHISCHIAN* Zeitschr. f. Hyg. Bd. 104, p. 256, 1925.

20. *LANGE & NOVOSSELSKY* Zeitschr. f. Hyg. Bd. 104, p. 286, 1925.

21. *MARTINI S.* Zeitschr. f. Hyg. Bd. 38, 1901.

22. *MARTINI E.* Klin. Jahrb. Bd. X, 1902.

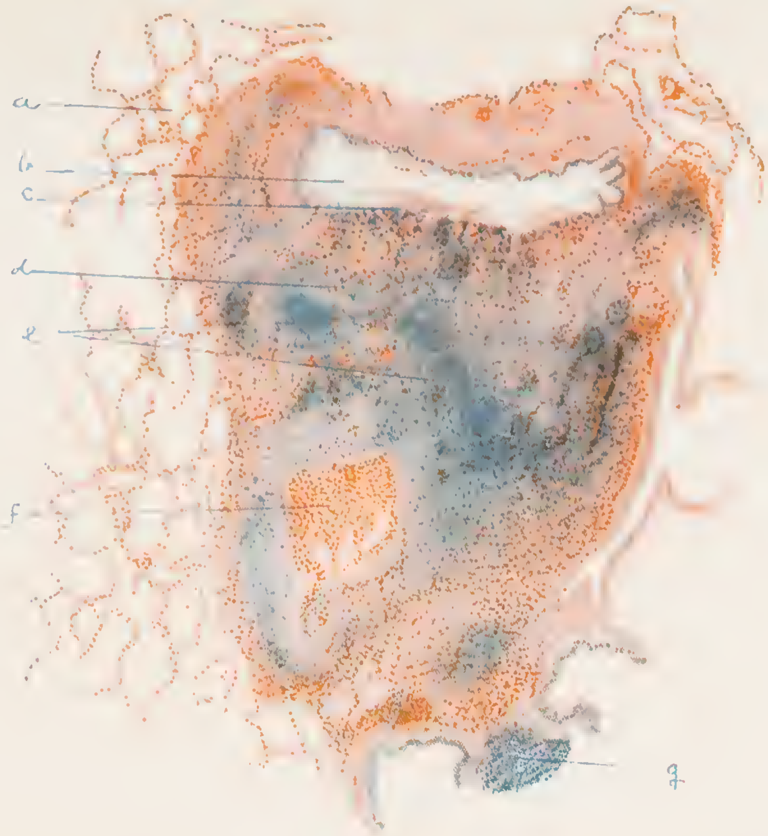
23. *MERESHKOVSKY* Centralbl. f. Bakt. Orig. Bd. 70 p. 368.

24. *NENNINGER* quoted after GOTSCHLICH.

25. *PAUL L.* Zeitschr. f. Hyg. Bd. 40 p. 468, 1902.

26. *SCHURUPOFF* Centralbl. f. Bakt. 1912, Bd. 65, p. 243.

27. *SCHURUPOFF* Russky Vratsh 1911 No. 33, p. 1301.

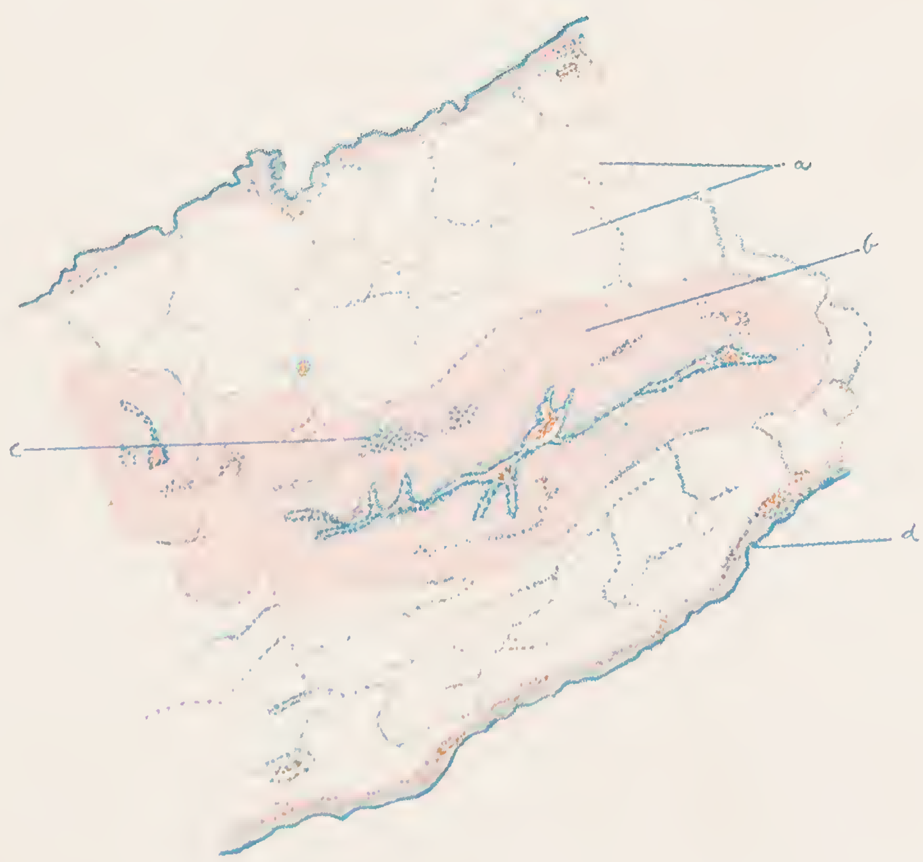


Colored Plate A. **Lung from Tarab 6. Group B. killed 52 hrs. after inhalation. (Reichert obj. 3 and ocul. 4) showing early localisation of B. pestis in a small bronchial lymph. gland.**

a. normal alveoli.
b. small bronchus, lower part with detached epithelium.
c. Leucocytes and plague bac. passing damaged ep. layer in streams.
d. infiltr. lymphatic tissue with hæmorrhages and plague bac.
e. groups of B. pestis.
f. small bl. vessel showing B. pestis entering upper corner through damaged epithelium.
g. unchanged lymph gland between two bronchi.

甲（色圖） 示乙種六號旱獺之肺組織卽吸入試驗隔五十二小時殺驗者（鏡接物三號接眼四號）示氣管枝淋巴腺疫菌局部現象

a. 氣胞常態
b. 氣管枝下部有分離上皮
c. 淋巴球及疫菌經過破壞上皮層
d. 淋巴組織出血及疫菌浸潤
e. 疫菌羣（過度染色）
f. 小血管示疫菌由破壞上皮入上角部
g. 不變淋巴腺在兩氣管間

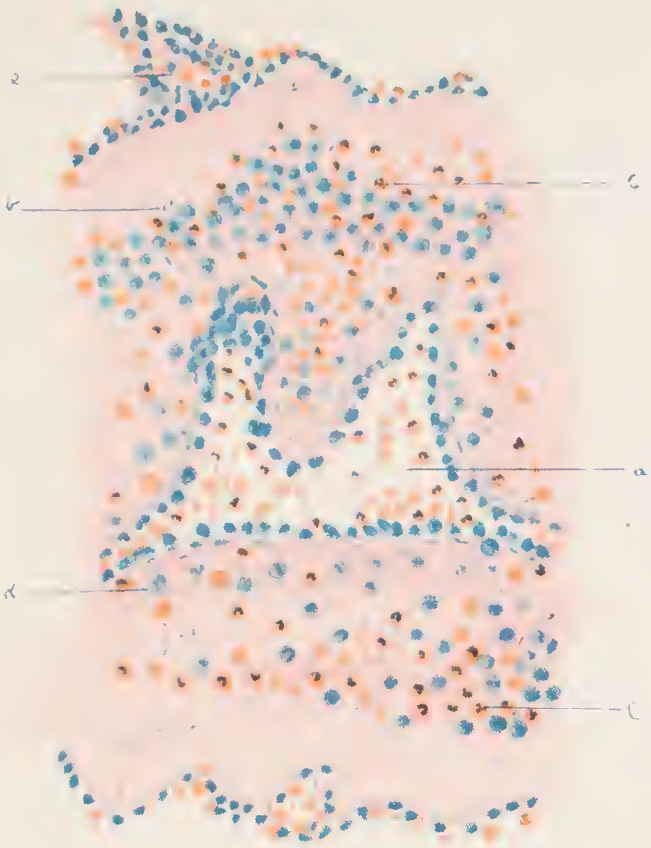


Colored Plate B. **Lung from Tarab 6. Group B. killed 52 hrs. after inhal. (Reichert obj. 3 and ocul. 4) showing œdematous area around small blood vessel.**

a. normal alveoli.
b. much dilated lymph space around small bl. vessel.
c. leucocytes and pl. bac. in œdem. tissue.
d. walls of bronchus.

乙（色圖） 示乙種六號旱獺肺組織卽吸入試驗隔五十二小時殺驗者（鏡接物三號接眼四號）示圍繞小血管水腫部

a. 氣胞常態
b. 多數擴大淋巴腔圍繞小血管
c. 淋巴球及疫菌在水腫組織中
d. 氣管各壁部

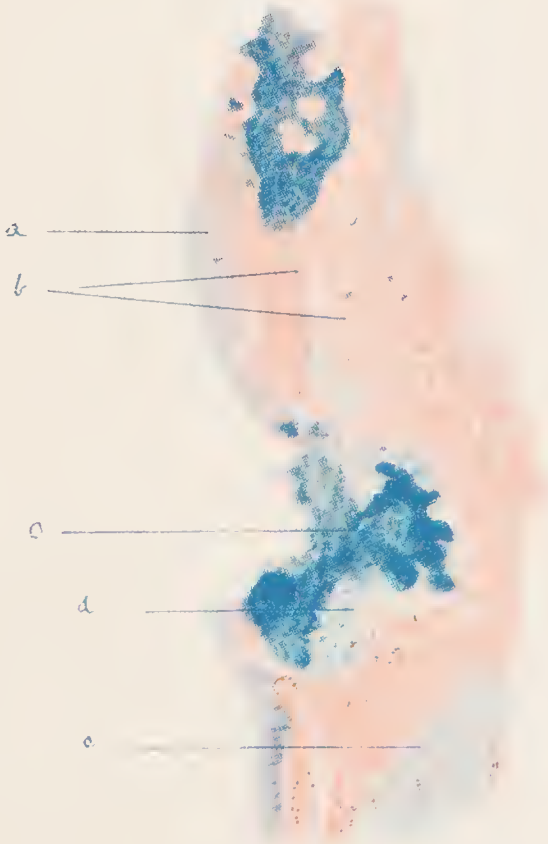


Colored Plate C. **Same as B under higher power (Reichert hist. immers. ocul. 2).**

a. portion of small bl. vessel showing early prolif. of endoth. cells.
b. plague bac. in œdem. lymph spaces.
c. leucocytes.
d. beginning hyaline changes.
e. normal alveolar walls.

丙（色圖） 與乙圖同在高度擴大鏡檢下

a. 小血管一部示內皮細胞叢生
b. 疫菌在淋巴水腫部
c. 淋巴球
d. 希阿林變性之開始
e. 氣胞壁之常態

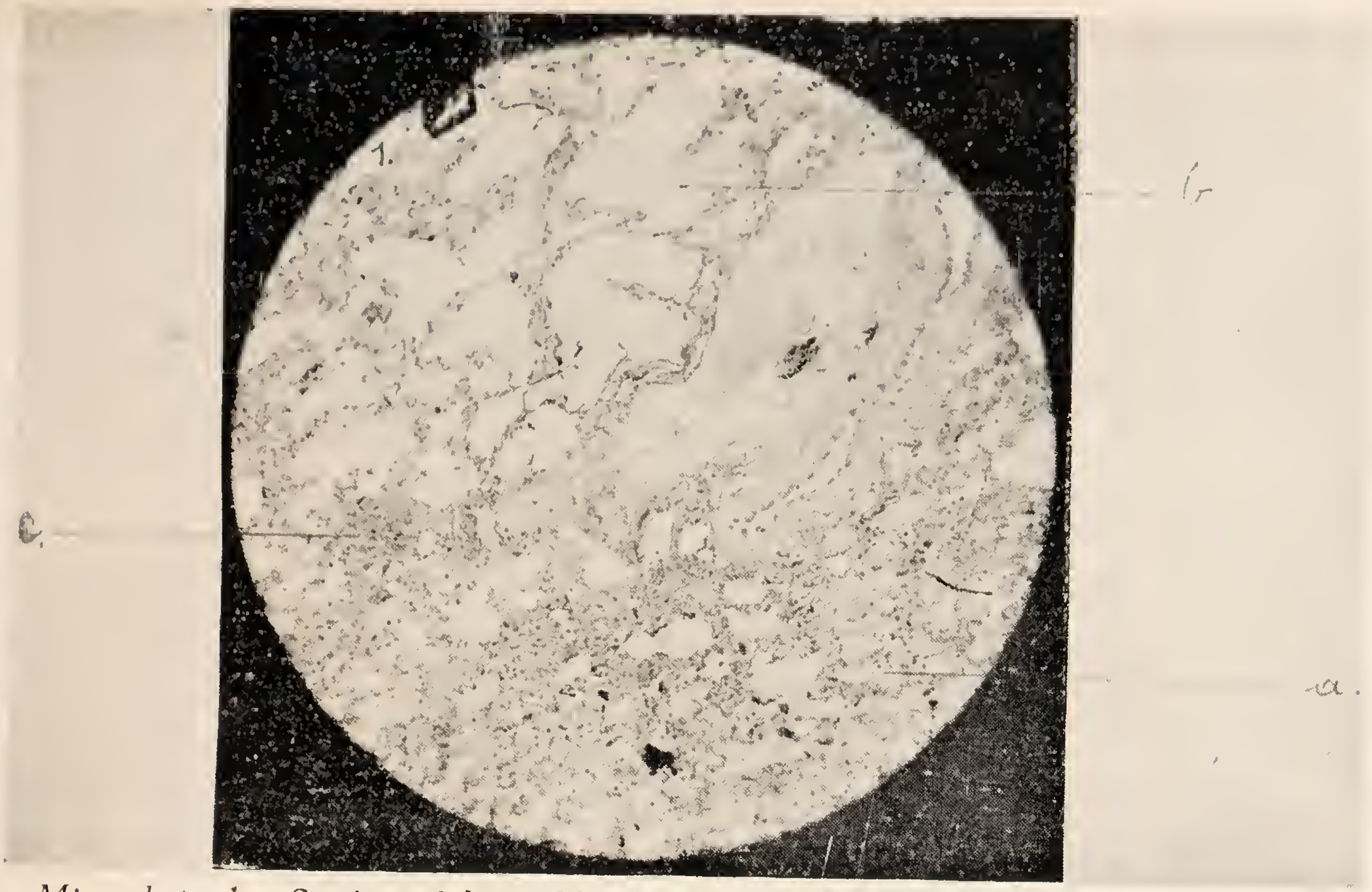


Colored Plate D. **Lung from Tarab 6. Group A. (Reichert obj. 5 and ocul. 2) showing ulceration in large bronchus. About 160 diam.**

a. swollen epithelium.
b. hæmorrhagic infiltration of whole wall.
c. ulcerous area with masses of plague bac. deeply stained.
d. neighboring œdem. area lightly stained.
e. muscular layer of bronch. wall.

丁（色圖） 甲種六號旱獺之肺（鏡接物五號接眼二號）示大氣管潰瘍部約160擴大

a. 上皮浮腫
b. 全壁浸潤及出血
c. 疫菌羣在潰瘍部（深染）
d. 水腫鄰部（輕染）
e. 氣管壁之筋肉層

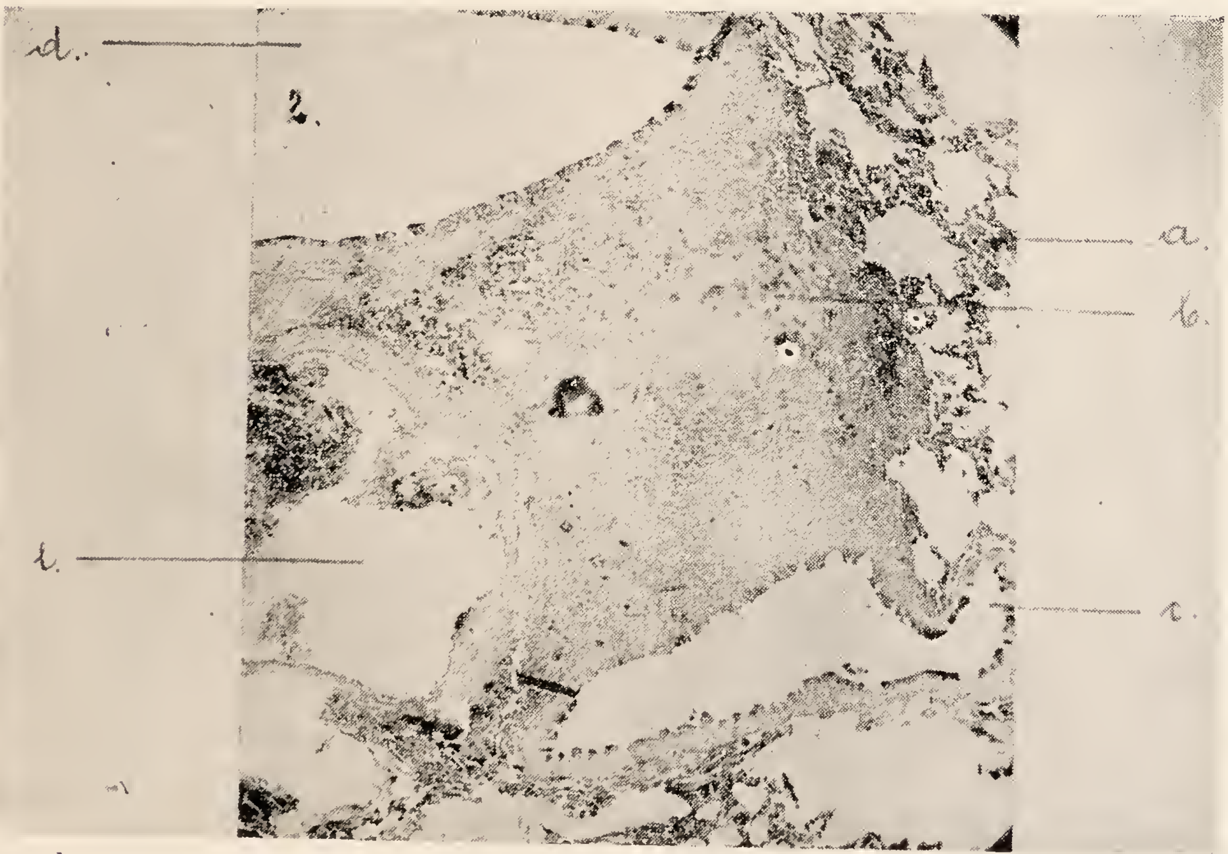


Microphoto 1. Section of lung, Tarab 3, group B, killed 42 hrs. after inhalation, showing early localisation of B. pestis in area of collapsed alveoli. (Magn. 60 diam.)

a. normal lung tissue.
b. emphysematous alveoli.
c. leucocytes invading shrunken alveoli with num. plague bac.

一（鏡檢圖）乙類旱獺三號肺組織吸入試驗四十二小時殺後驗示疫菌在破壞氣胞局部（六十直徑擴大）

a. 肺組織之常態
b. 氣胞氣腫
c 淋巴球同多數疫菌襲入氣胞內

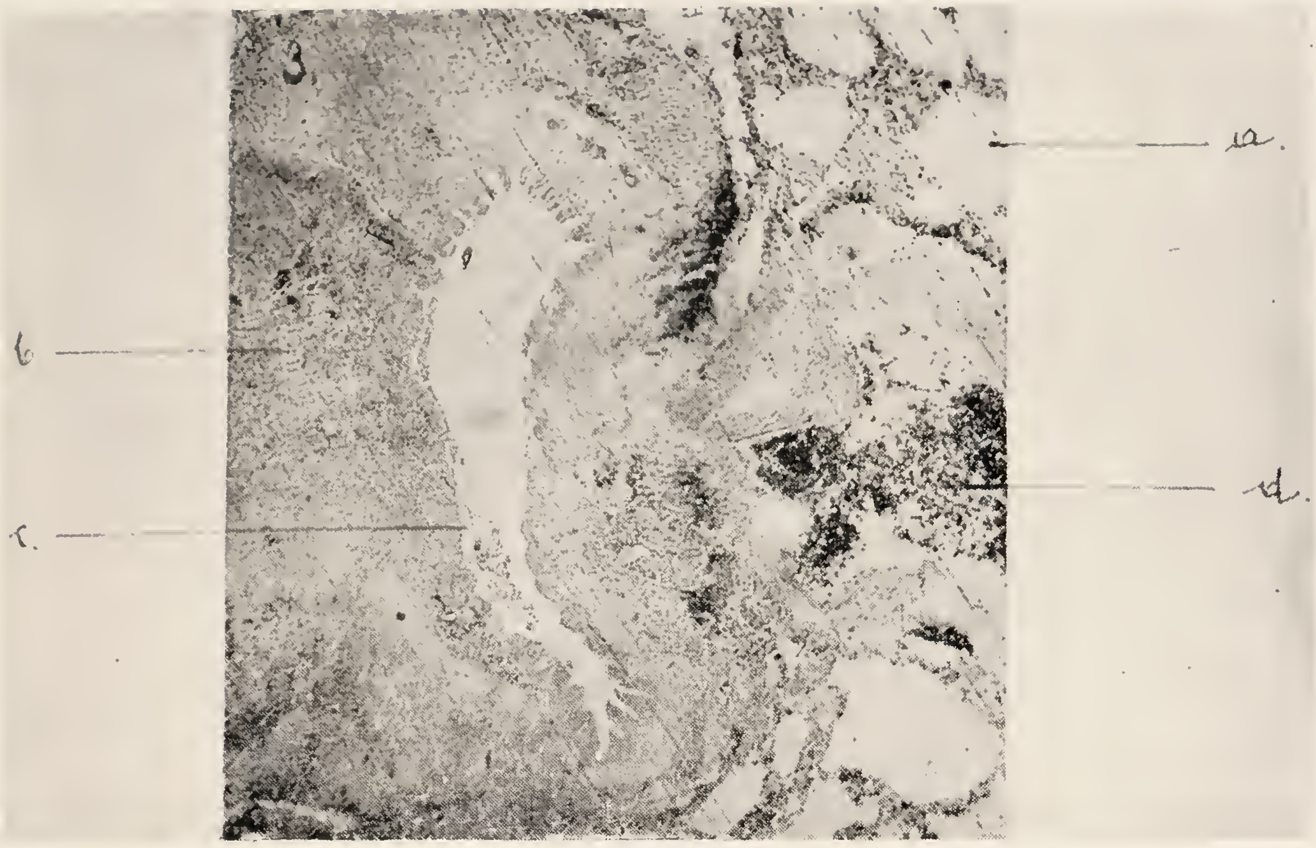


Microphoto 2. Section of lung, Tarab 5, group B, killed 51 hours after inhalation, showing early invasion of small bronch. lymph gland (Magn. 60 diam.)

a. normal alveoli.
b. decaying nuclei with masses of pl. bac. near center of gland.
c. small bronchus with undamaged epithelium.
d. another bronchiole with normal epithelium.
e. bl. vessel containing increased number of white cells in lumen.

二（鏡檢圖）乙類旱獺五號肺組織吸入試驗五十一小時殺後驗示氣管枝淋巴腺被早期侵襲（六十直徑擴大）

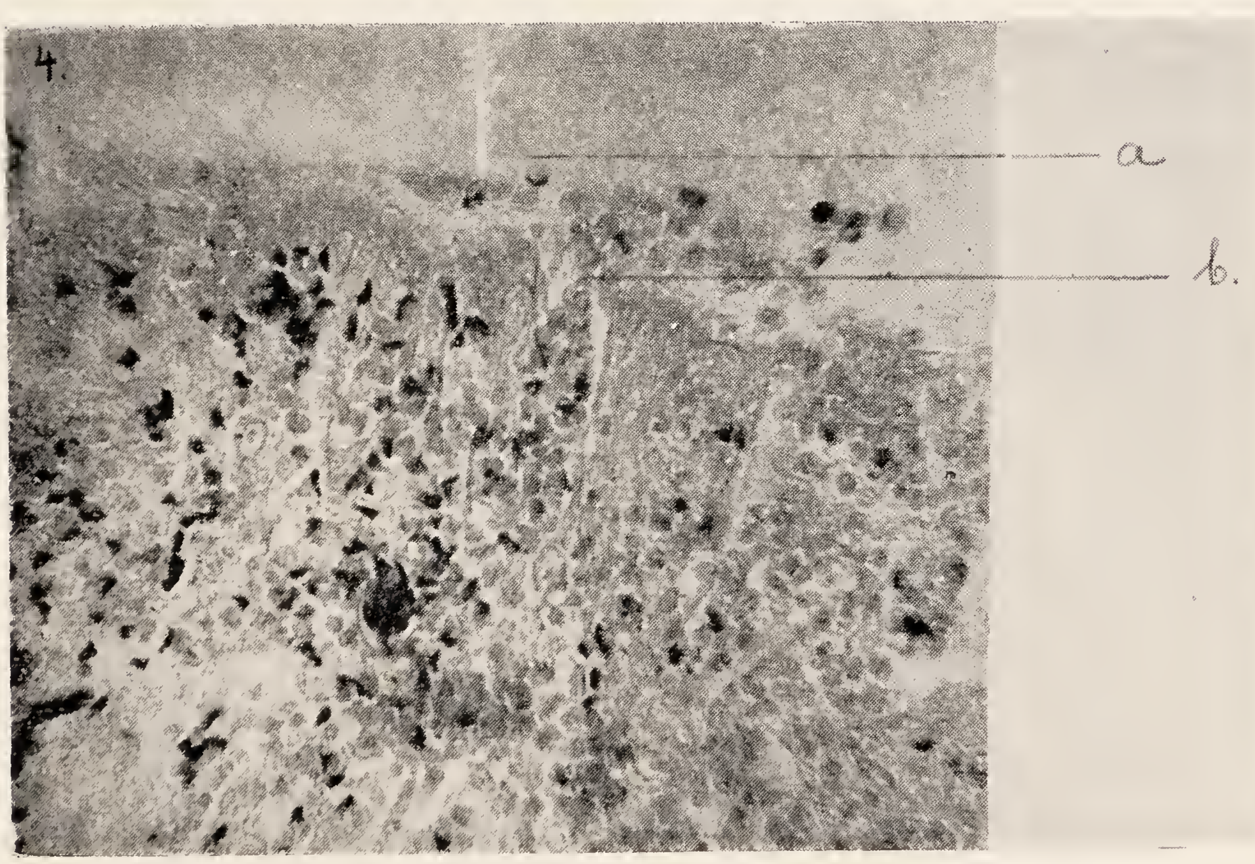
a. 氣胞常態
b. 近腺中央有腐核與疫菌群
c. 氣管枝與未破壞上皮
d. 又一氣管與上皮常態
e. 血管內含白球增加



Microphoto 3. Section of lung, Tarab 6, group B, killed 52 hours after inhalation, showing slightly more advanced changes than 2 in bronchial lymph gland (Magn. 70 diam.)

a. normal alveoli
b. congested lymph gland containing plague bac.
c. small bronchial wall invaded by leucocytes. Eithelium damaged or detached and at places invaded by B. pestis.
d. small congested bl. vessel.

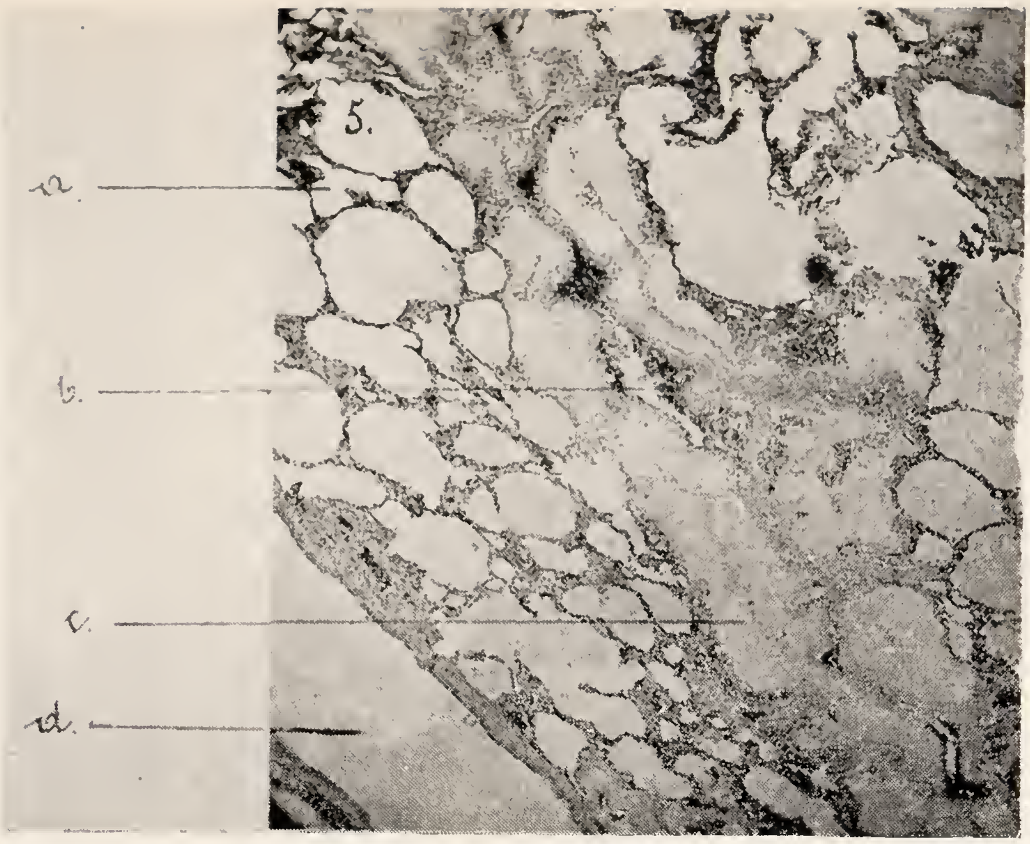
三 (鏡檢圖) 乙類旱獺六號肺組織吸入試驗五十二小時殺後驗示比在氣管淋巴腺之二例稍變 (七十直徑擴大)
a. 氣胞常態
b. 淋巴腺充血及含疫菌
c. 小氣管枝壁淋巴球上皮侵入又被疫菌侵入破壞各部
d. 血管稍被充血



Microphoto 4. Bronchial wall in Microph. 3 magnified 450 diam.

a. lumen of bronchus containing pus cells and pl. bac.
b. Plague bac. and leucocytes passing like streams between lumen of bronchus and surrounding coats.

四 (鏡檢圖) 鏡驗三之氣管壁四百五十直徑擴大
a. 氣管腔含有膿球及疫菌
b 疫菌及淋巴球在氣管腔及周圍經過

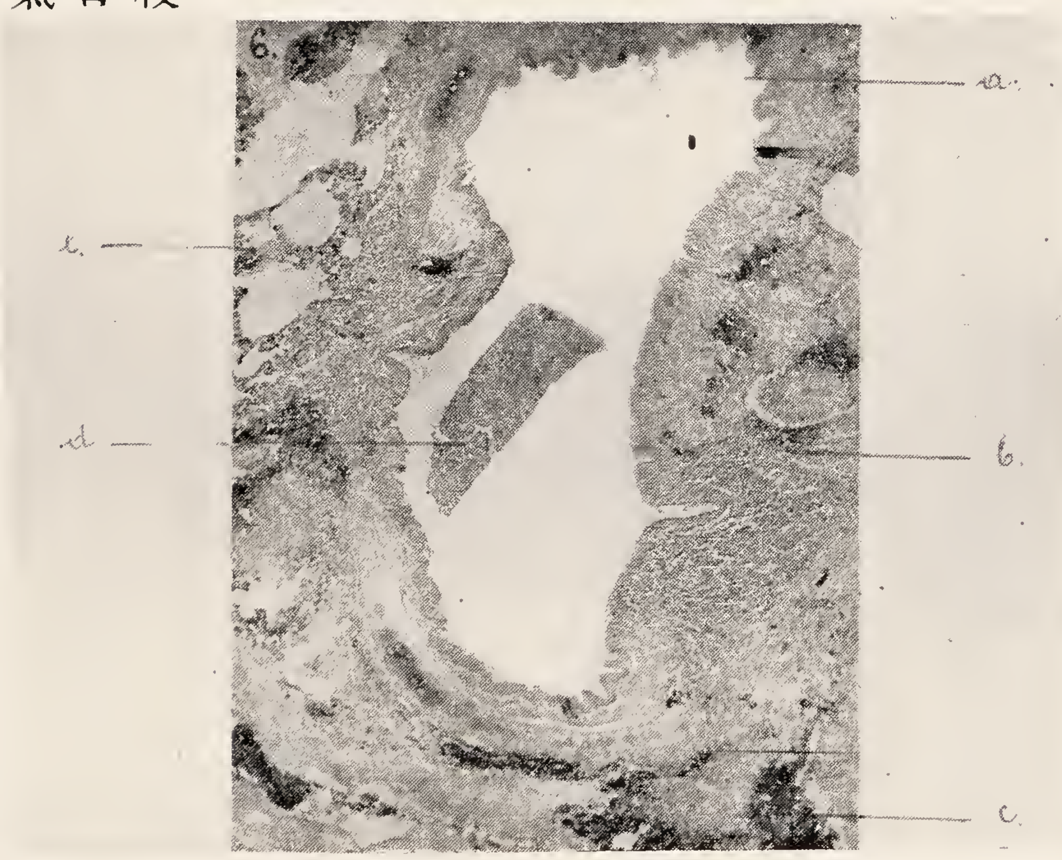


Microphoto 5. Section of lung, Tarab 6, Group B, killed 52 hours after inhalation, showing plague bacilli in dilated lymph spaces around a small blood vessel. (Magn. 60 diam.)

a. unchanged lung tissue.
b. small blood vessel with no plague bac.
c. much dilated lymph spaces containing leucocytes and B. pestis.
d. small bronchus.

五.（鏡檢圖）乙 類旱獺**六**號肺組織吸入試驗**五十二**小時殺後驗示疫菌在擴張淋巴隙圍繞一小血管（**六十**直徑擴大）

a. 未變肺組織
b. 小血管示疫菌缺乏
c. 多數擴大淋巴隙含有淋巴球及疫菌
d. 氣管枝

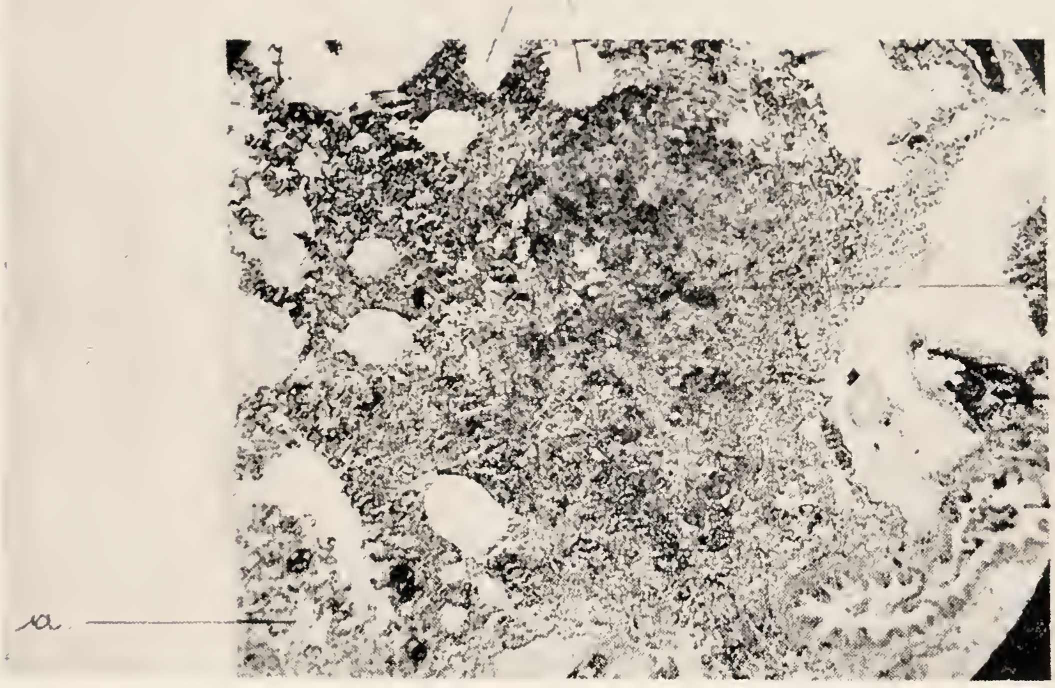


Microphoto 6. Section of lung, Tarab 6, Group B, taken near hilus of the same affected part, showing a clump of pl. bacilli in lumen of a bronchus (Magn. 70 diam.)

a. normal bronchial wall and epithelium.
b. lymph node containing pl. bac. on posterior aspect.
c. small haemorrhages in gland.
d. solid piece consisting of pus cells and pl. bac.
e. lung alveoli slightly infiltrated.

六（鏡檢圖）乙 類旱獺**六**號肺組織由同病部分取出示氣管腔內疫菌堆積（**七十**直徑擴大）

a. 氣管壁及上皮之常態
b. 淋巴部含疫菌在後部
c. 腺內之微出血
d. 硬固部含有膿球及疫菌
e. 肺氣胞輕度侵潤

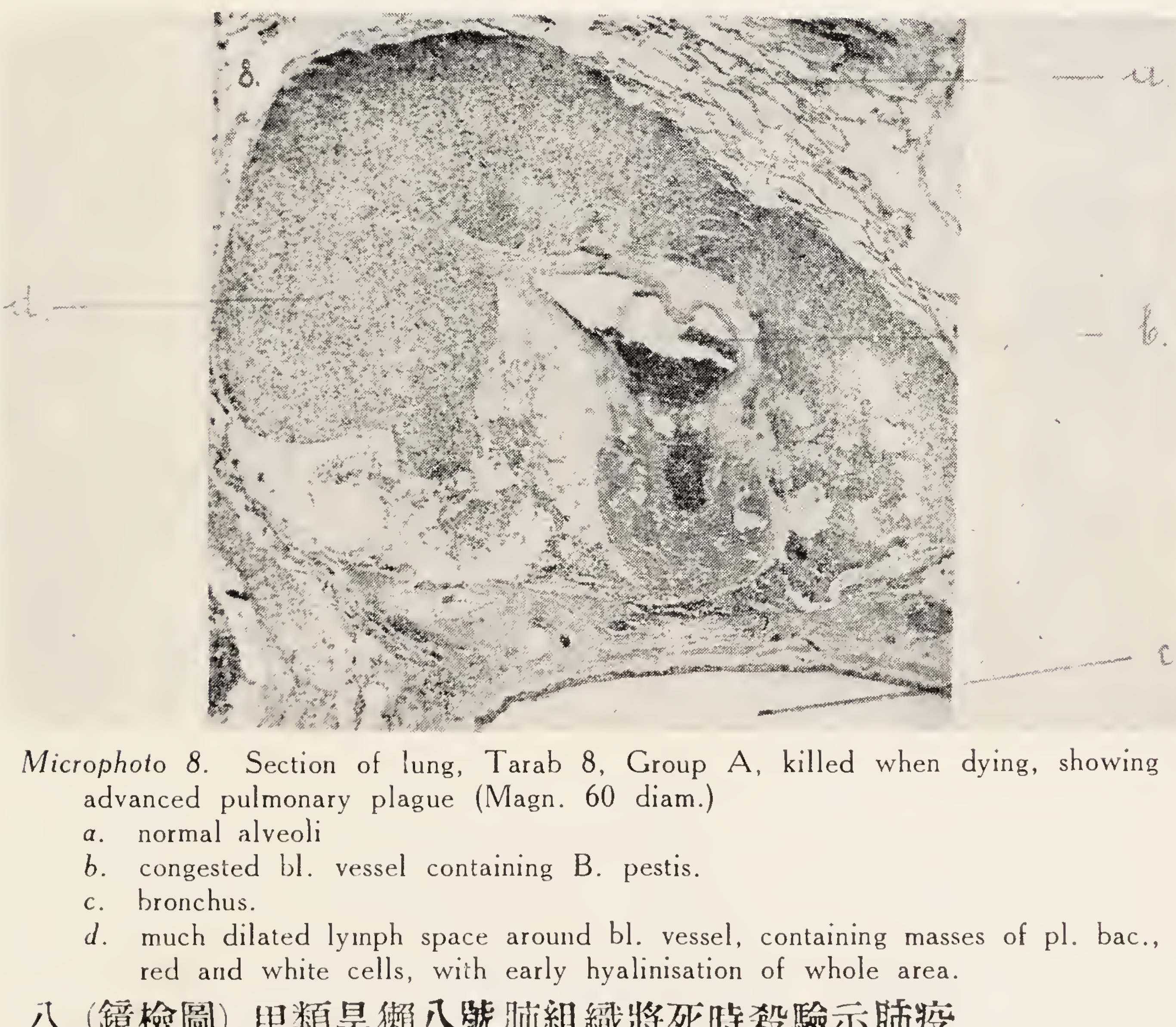


Microphoto 7. Section of lung of suslik 7, group A, killed 68 hours after inhalation, showing pneumonic focus. (Magn. 70 diam.)

a. normal lung tissue.
b. emphysematous alveoli.
c. hepatised area containing numerous pl. bac. in black clusters and haemorrhages.
d. small bronchus.
e. congested bl. vessel.

七（鏡檢圖）甲類鼠**七號**肺組織吸入試驗**六十八**小時殺後驗（將死）（示肺炎狀）（**七十**直徑擴大）

a. 肺組織常態
b. 氣胞氣腫
c. 肝變部在黑堆處及出血部見多數疫菌
d. 氣管技
e. 充血的血管

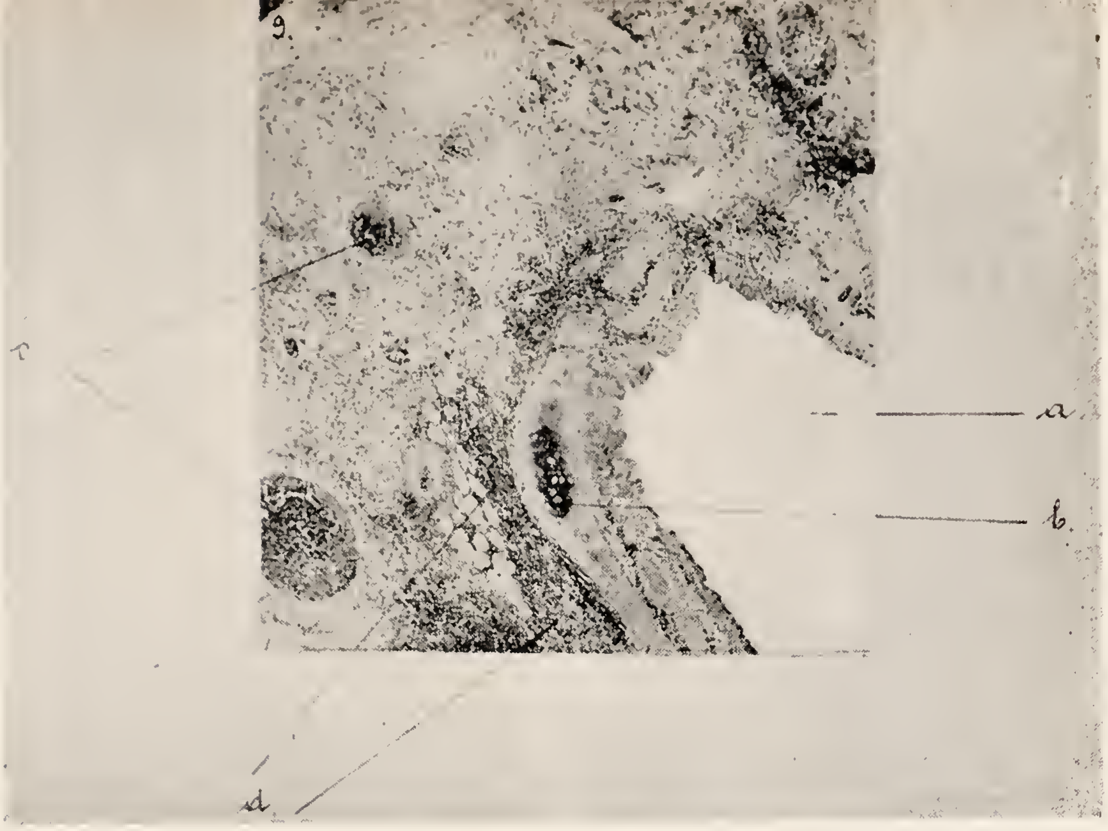


Microphoto 8. Section of lung, Tarab 8, Group A, killed when dying, showing advanced pulmonary plague (Magn. 60 diam.)

a. normal alveoli
b. congested bl. vessel containing B. pestis.
c. bronchus.
d. much dilated lymph space around bl. vessel, containing masses of pl. bac., red and white cells, with early hyalinisation of whole area.

八（鏡檢圖）甲類旱獺**八號**肺組織將死時殺驗示肺疫（**六十**直徑擴大）

a. 氣胞常態
b. 充血血管含疫菌
c. 氣管
d. 多數擴張淋巴隙圍繞血管含有疫菌群赤白血球有早期希阿林變性部

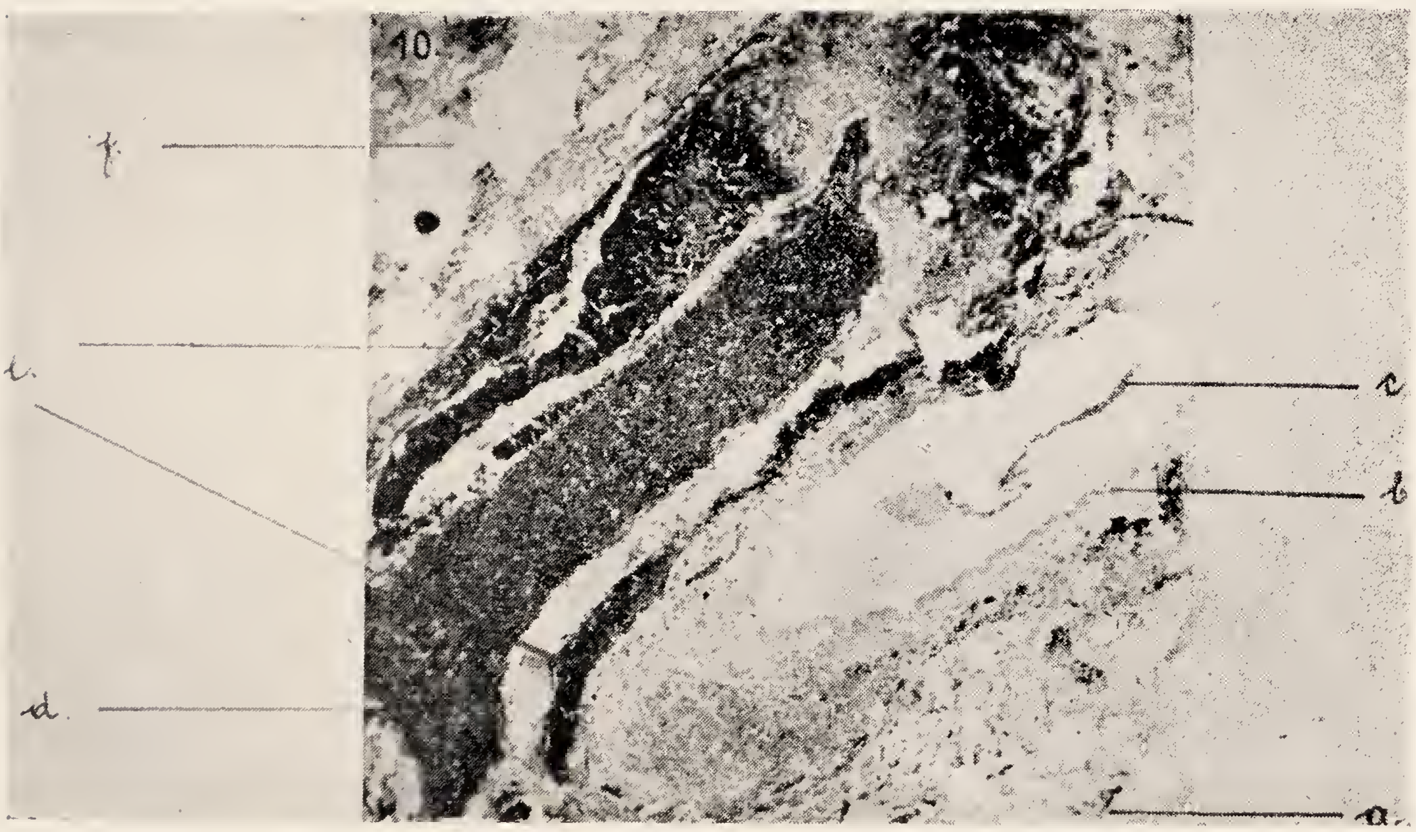


Microphoto 9. Section of lung, Tarab 8, group A, near a big bronchus showing advanced changes in experim. pulmonary plague (Magn. 60 diam.)

a. bronchus
b. cartilage.
c. groups of plague bacilli.
d. haemorrhages around bronchial wall.

九 (鏡檢圖) 八號旱獺八類肺組織近大氣管示肺疫變狀
(六十直徑擴大)

a. 氣管
b. 軟骨
c. 氣胞中疫菌
d. 圍繞氣管壁出血



Microphoto 10. Section of lung, Tarab 10, group A, showing most advanced changes in pulmonary plague (Magn. 70 diam.)

a. unchanged alveoli.
b. wall of small bronchus.
c. desquamated epithl cells with numerous pl. bac.
d. small congested bl. vessel containing numerous pl. bac. and surrounded by copious haemorrhagic areas.
e. extensive haemorrhages on either side of bl. vessel.
f. dilated alveoli.

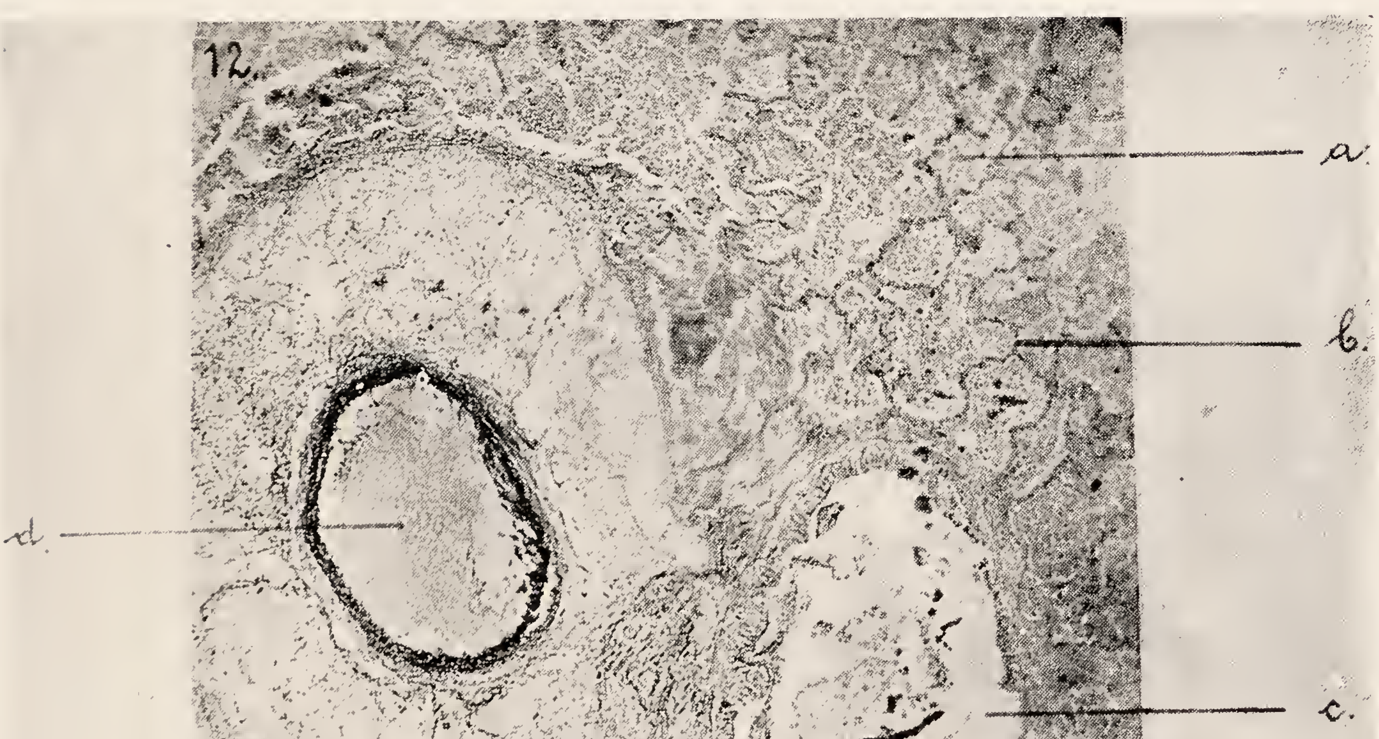
十 (鏡檢圖) 甲類旱獺十號組織示肺疫病 (七十直徑擴大)

a. 未變氣胞
b. 氣管枝壁
c. 剝脫上皮細胞與多數疫菌
d. 充血血管含有多數疫菌及有出血部圍繞
e. 血管各邊充血
f. 擴大氣胞

Microphoto 11. Section of lung, Tarab 11, group A, showing advanced changes in pulm. plague together with thrombus in blood vessel. (Magn. 60 diam.)

a. unchanged alveoli.
b. large thrombus containing numerous pl. bac. besides blood cells.
c. vessel wall.
d. extensive haemorrhages around blood vessel.
e. small lobular pneumonic patch.

十一（鏡檢圖）甲類旱獺**十一號**肺組織示肺疫病變同血管內血栓（**六十**直徑擴大）
a. 未變氣胞
b. 大血栓血球外含多數疫菌
c. 血管之壁
d. 著明出血圍繞血管
e. 小葉肺炎部



Microphoto 12. Section of lung, Tarab 9, group A, showing typical pneumonia of the lobar type (Magn. 60 diam.)

a. Completely hepatised alveoli containing numerous pl. bac.
b. hyalinised appearance of alveolar walls.
c. small bronchus with detached epithelium and some hyalinisation besides numerous pl. bac. and pus cells in lumen.
d. blood vessel surrounded by network of hyaline substance.

十二（鏡檢圖）**甲**類旱獺**九號**肺組織示葉型肺炎（**六十直徑擴大**）
a 完全肝變之氣胞含有多數疫菌
b. 氣胞壁希阿林變性狀況
c. 氣管枝與破壞上皮及些希阿林變性尚有多數疫菌及膿球在腔內
d. 血管被網樣希阿林質圍繞之

28. *SHIBAYAMA G.* Far East Ass. of Trop. Med. 2nd. Congress Hongkong 1912 p. 130.

29. *SNEL* Zeitschr. f. Hyg. und. Infekt. Bd. 40, 103, 1902.

30. *STILLMAN & BRANCH* Jl. Exp. Med. Vol. XL, pp. 733-742.

31. *STILLMAN & BRANCH* Jl. Exp. Med. Vol. XLI. pp. 623-630.

32. *STRONG CROWELL & TEAGUE* The Philipp. Jrl. of Science. B. 1912, T. 7. No. 3.

33. *STRONG* Mukden Report. Manila 1912, p. 385/86.

34. *TSCHURILINA & NOSSINA* Russky Vratsh 1914, 10.

35. *TSURUMI, HARA, IMAI, AWOKI & SAKAMOTO.* The Japan. Med. World, 1923, T. 3. No. 7/8.

36. *TSURUMI & COLL.* Dairen, 1923, pp. 27/28.

37. *WULIENTEH* The Nat. Med. Jl. of China Vol. VII. p. 178, 1921.

38. *WU LIEN-TEH, CHUN & POLLITZER* Jl. Hyg. Vol. 21. p. 289. 1923.

39. *WU LIEN-TEH, CHUN & POLLITZER* Jl. Hyg. Vol. 21. p. 307. 1923.

40. *WU LIEN-TEH & EBERSON* The Am. Jl. of Inf. Dis. Vol. 20, No. 2.

41. *WU LIEN-TEH & LIN* Manch. Plague Prev. Service, Report 1923-24.

42. *WU LIEN-TEH & WOODHEAD.* Jl. Path. & Bacter. 1914.

PLAGUE TRANSMISSION THROUGH THE ECTOPARASITES OF THE TARABAGAN.

Reprinted from The American Journal of Hygiene, Vol. V, No. 2, 196-201, March, 1925.

In the summer of 1923 it was definitely established by our bacteriological investigations that Siberian marmots (tarabagan—*Arctomys bobac*) are subject to big epizootics of plague and hence undoubtedly responsible for the frequent human outbreaks in Transbaikalia. Up to that time the attention of the workers in those parts had been absorbed by the investigation of this main problem both in the fields and the laboratory, and little attention was paid to side issues. Now the opportunity had come to attempt a solution of problems of this category, most prominent among which seemed to be the part played by the tarabagan parasites in the spread of plague infection. An active rôle of those parasites could not be taken for granted *a priori,* at least as far as the spread of infection from animal to man was concerned, because the trapping, killing and skinning of the valuable animal give ample opportunities for direct contact; and indeed in most of the outbreaks on record such a direct infection was at least probable and in not a few even certain. On the other hand, it had to be borne in mind, that the parasites, including the fleas, stick with a remarkable tenacity to the corpses and even to the pelts of the animals. Hence it was of great practical importance to determine whether they might harbour the infection or not.

THE TARABAGAN FLEA (*Ceratophyllus silantievi*).

Apparently the first author who emphasized on theoretical considerations a possible rôle of the tarabagan flea (*Ceratophyllus silantievi* Wagner 1898) was Tiraboschi (1904). Dudchenko (1909) mentioned that the tarabagan fleas could bite man; he recorded no experiments done in this respect and it would appear that he relied solely upon the communications of the hunters; his statement that after the bite, a red spot appears at the site certainly cannot be generalized. One of us (W. L. T. 1913) proved that the fleas readily bite man under experimental conditions. Dudchenko saw in 1915 one of his burrow-diggers bitten on the neck by a tarabagan flea. This same observer pointed out that the tarabagan fleas—like those of the other Transbaikalian rodents—are able to emancipate themselves from their hosts for considerable periods, during which time they vegetate in the fields. Jettmar (1922) described a human plague outbreak, apparently caused by such "free living" fleas, because the group of hay harvesters decimated by the pest had in all probability not been in contact with tarabagans, but had been much molested by

fleas. The suspicion thrown upon the *Ceratophyllus silantievi* by this and a few other outbreaks with a more doubtful anamnesis was much strengthened by Sukneff (1922) who saw bipolar staining plague-like bacilli in a flea, picked up from a naturally-infected tarabagan. This, however, could not be confirmed by cultural or experimental tests. Furthermore, a second series of biting experiments (1923) by us convinced us that the fleas do not defecate when biting, and hence nothing short of an actual transmission of the disease by means of those parasites could prove their rôle.

We started such biting experiments in the spring of 1923 in Harbin by letting one supposedly infected tarabagan flea feed upon a healthy tarabagan and a healthy guinea pig. Both animals survived. The flea, which had bitten an infected animal on May 31st died on June 6th without showing any evidence of plague infection *post mortem*. It was evident that no successful flea experiments could be carried out in Harbin, because the tarabagans, already almost flea-free when they reach here after a long journey by rail, soon lose the few remaining fleas in the cages. Therefore, when we had the opportunity to work with our Russian colleagues in Transbaikalia, we suggested to them a continuation of such experiments on the spot. They consented readily and the following two experiments were performed jointly by Chinese and Russian workers.

(*a*) On a tarabagan, artificially infected 3 days previously by injection, 32 *Ceratophylli silantievi* were exposed on August 23. The animal succumbed to plague early on the 27th. Before it was removed from its cage a healthy tarabagan was exposed in the second compartment of the cage, separated by a wire screen. After 3 hours a guinea pig was placed for half an hour on the dead tarabagan. Then the dead animal was searched for fleas and 7 live ones were recovered which were placed on the above mentioned healthy tarabagan. Neither this tarabagan nor the guinea pig became infected.

(*b*) From a naturally infected tarabagan, found on August 24, 22 fleas were recovered besides 13 lice. 13 of the fleas were placed on a healthy guinea pig; a second guinea pig was injected with an emulsion of 6 fleas, a third one with an emulsion from the feces of three fleas obtained on the 27th and 29th of August. Those three animals, as well as a fourth guinea pig which had been placed on the tarabagan before all the fleas had been removed, survived. This result was the more disheartening as the lice collected on the naturally infected tarabagan contained virulent *B. pestis*.

A third experiment was performed by Sukneff, after our departure, by exposing on an artificially infected tarabagan 200 tarabagan fleas. When the animal died, a healthy tarabagan was exposed in the adjacent compartment for 3½ hours. Then the dead body was searched for fleas; only 8 of the 200 could be found, 7 of which were exposed on the above mentioned healthy tarabagan. This animal survived. Sukneff saw, however, many plague like bacilli in the crushed 8th flea, and a guinea pig injected with part of its body died of plague.

(c) *Successful experiment.* Thus there could be no more doubt that the tarabagan fleas can actually contain living and virulent plague bacilli, and the rather discouraging results of the 1923 campaign could not shake our firm belief in the infective rôle of the fleas and our hope to overcome gradually the great difficulties of those experiments. With this object in view, we started by ourselves a new series of experiments in August 1924, choosing as our base on this occasion our well equipped laboratory at Manchouli Hospital, where Resident Medical Officer, Dr. Li An, assisted us.

The first two experiments (placing three fleas and one flea respectively, collected from animals succumbing to artificial infection, upon a tarabagan) gave no positive result; the tarabagan (No. 309) died 6 days after the second exposure, but showed at autopsy no plague, its death being due to a streptococcal infection from a wound on its right hind leg caused by the snare. It could be clearly seen that it was very difficult to keep these wild tarabagans alive under the strict confinement necessitated by the experiments, and we resolved to perform the next test with guinea pigs only. We think that the positive result of the third experiment is due to this decision. The following are the details :

(*d*) A healthy guinea pig (No. 311) was infected cutaneously with one loop of a virulent culture on August 22. Soon after infection 17 tarabagan fleas were fed upon it. The guinea pig was found dead on 27th in the morning. Before it was handled, a healthy guinea pig, kept up to that time in a room far away from the laboratory, was placed in a clean bucket. Then guinea pig 311 was searched for fleas; five lively tarabagan fleas, found upon it, were collected in a clean test tube and exposed on the healthy guinea pig, the greatest care being taken not to touch the animal or the inside of the bucket. Only then was the autopsy on guinea pig 311 performed; this revealed typical plague (right inguinal bubo) with marked septicemia. The guinea pig upon which the five fleas had been exposed (No. 313) was afterwards kept in the laboratory; an accidental infection of the animal is out of the question, because no more plague experiments were performed and there was no previously infected animal in the room. The animal began to sicken on September 2 and showed on the 4th symptoms of plague infection. Being unusually strong, this male animal managed to survive up to the morning of the 6th. The autopsy showed a small right inguinal bubo and otherwise typical signs of subacute plague (large spleen with many nodes, the largest being bigger than the pea-sized-nodes in the lungs). Smears and cultures from the organs were positive, numerous plague bacilli being seen in the bubo and spleen. The whole guinea pig is now preserved in our museum. Another guinea pig, 316, infected cutaneously with the spleen culture on September 8th, succumbed after 4 days, showing at autopsy right axillary bubo and other signs of plague.

We can assert that this one experiment forms positive proof that *Ceratophyllus silantievi* is capable of spreading plague infection from one animal to another. It would be highly desirable to supplement this

knowledge by observations upon the flea rate and upon the density of the flea infestation in the different tarabagan districts. It can be inferred from casual observations that the flea rate, which is seemingly not very low immediately after hibernation, decreases in spring and early summer, and increases in the latter part of the summer. Some authors state that the tarabagans free themselves to a large degree from their fleas before they begin to hibernate. The only exact observations were made by us in the spring of 1923 and in the summer (August) of 1924 upon tarabagans transported after their capture for about 40 miles to Manchouli. Hence our figures are certainly too low, especially those of 1924, when the animals were caught under difficult conditions. We found the 1924 summer flea rate only slightly higher (1.5 against 1.3) than that in spring 1923. Further investigations upon this whole problem, including the question of the "free living" fleas, which has never been properly undertaken, seem very necessary. The practical difficulties accompanying such observations on a large scale are, however, well nigh insurmountable in those bare regions. It will be easier to study infected fleas both *in vitro* and *post mortem*. Thus far we could spare no living fleas for such tests, and the few dead specimens found on the infected animals were not well enough preserved. Neither living nor dead fleas were found on guinea pig 313.

The tarabagan louse (Linognathoides citelli Cummings).

Experienced hunters assert that the tarabagan lice can crawl upon human beings from freshly captured animals, and also that they remain alive on the skins for weeks (Jettmar, 1922). Wassilewski (1921) actually saw a louse crawl from a tarabagan corpse on his knee. The first exact observation was made by us in the spring of 1923, when we succeeded in causing a louse, starved for three days, to bite one of us. In 1922, Sukneff saw plague-like bacilli in smears from 3 lice taken from a natural plague-infected tarabagan. In the summer of 1923 we and Sukneff working in Siberia found 13 lice on a tarabagan which had succumbed to natural plague infection; a film made from one of these showed a considerable number of plague-like bacilli. A guinea pig injected with an emulsion of three of the lice succumbed after six days to typical plague (bilateral inguinal buboes); a second guinea pig upon which 10 living lice were placed, survived. The positive results obtained with these lice are the more remarkable, as the fleas of the same tarabagan were to all appearances free from plague infection. After our departure Sukneff made similar experiments with lice from an artificially infected tarabagan and obtained again positive results in smears and by injection. Controls of 8 lice upon a healthy tarabagan were negative. Jettmar (1924) made an exhaustive study of plague infection of the tarabagan lice. He found that the lice suck the blood of man, as well as that of the ground squirrel and guinea pig, but will not live on a strange host for any length of time. When the lice suck plague blood, the bacilli grow rapidly in clusters, and finally fill up the lumen of the stomach; the lice die after two or three days of the infection, displaying

a characteristic red colour, due to a sedimentation of hemoglobin; the feces of the lice contained large numbers of plague bacilli in pure culture, while none were found outside the intestinal tract; the lice were found to contain virulent plague bacilli for at least 13 days. Jettmar finally succeeded to infect a health sisel by placing upon it 40 tarabagan lice collected 24 hours previously from a dead artificially-infected tarabagan.

The Tarabagan Tick. (*Rhipicephalus* (*R. haemaphysaloides* ?).)

So far we have not been able to induce this tick to bite man, even after a starvation of almost three weeks. The ticks seem to disappear quickly when placed upon a guinea pig. A few experiments done with plague infection gave negative results; neither a tarabagan, upon which live ticks, collected from a plague injected tarabagan, were placed, nor a guinea pig injected with an emulsion from such ticks succumbed to plague. Though perhaps—even when a rôle of the ticks can be taken for granted—they may not spread plague infection *actively*, the insects which stick tenaciously to corpses and skins, might serve as *passive* spreaders of infection. For this reason these experiments will be continued.

CONCLUSIONS.

Now that we have finally succeeded in infecting a healthy animal by means of tarabagan fleas, it may be stated that they undoubtedly play an important part in the spread of the infection, not only from animal to animal, but also from animal to man; we are convinced that they were involved not only in the constant Siberian outbreaks, but also in others where a direct contact with infected animals occurred. The lice are certainly an important link in the propagation of the disease from animal to animal—our observation on the lice and fleas from one and the same naturally infected tarabagan is certainly illustrative in this respect. It is at present difficult to gauge how far the lice actually spread the disease to man. A few outbreaks, where the affected had contact with tarabagan skins only, seem somewhat suggestive of their rôle. Our observations, made both on the fleas and the lice, thus show that any attempt to control the handling of tarabagans and the trade with their skins must include not only bactericidal, but also insecticidal measures.

References.

WAGNER. Horae Soc. Ent. Ross., 1898, XXXI, pp. 555-594.
TIRABOSCHI. Arch. de Parasitologie, 1904, VIII, p. 161.
DUDCHENKO. Vj. Obsh. Guig., 1909, pp. 1045-1089
WU LIEN TEH, Jl. Hyg., 1913, XIII, No. 3.
DUDCHENKO. Vj. Obsh. Guig, 1915, p. 1231 and foll.
JETTMAR. Jl. Transbaikalia Med. Soc., 1922, pp. 1-13.
SUKNEFF. Publ. of Harbin Med. School, 1922, 1, pp. 213-234.
WU LIEN TEH. North Manch. Plague. Prev. Serv. Rep., 1923, IV, pp. 111-153.
WASSILEWSKI. Harbin Med. Jl., 1921, No 1-2, pp. 27-37.
JETTMAR. N. Manch. Plag. Prev. Serv. Rep., 1924, IV, pp. 231-234.

WU LIEN TEH,
J. W. H. CHUN,
R. POLLITZER.

PRACTICAL ASPECTS OF PLAGUE IN WILD RODENTS.

SPECIAL NEW SUPPLEMENT III IS HEREWITH INCLUDED.

(*League of Nations, Health Section, Pamphlet* C.H. 360).

Geneva, Oct. 7, 1925.

INTRODUCTION.

In my last paper on "Plague in Wild Rodents" at the F.E.A.T.M. Conference, Singapore, 1923[1], I drew attention to various species of these animals distributed in different parts of the world which have been proved to suffer from natural plague. This list has been considerably augmented during the last two years, so that I feel justified in having it revised and inserted as an appendix (see Appendix I).

NOTES ON NEW SPECIES ADDED.

Among the changes will be noted the inclusion of several new species of *South African* wild rodents in which plague has been definitely established. In addition, two species of carnivora—the mongoose (*Cynictis penicillata*) and the suricat (*Suricator suricator*)—have been found to be involved. Mitchell believes that because only a small proportion of the dead carnivora actually showed bacillus pestis they probably died from toxin-poisoning from the infected rodents devoured by them.

Some observations made in Russian Turkestan in 1923-24, when two villages (Ak-Kamish and Meskin) were attacked by plague, may be interesting. Here both pneumonic and bubonic types occurred, and neither domestic nor wild rodents could be found during the outbreak. However, it appeared that a severe epizootic had raged among wild rodents in the autumn of 1923, and the first human cases were traced to them during harvest time when the *dshugari* or millet was collected. Soon after the epidemic NIKANOROFF actually proved the existence of plague in two wild rodents. That particular region of Turkestan seems to have been free from any previous visitation and this seems to support my contention[2] "that the several outbreaks originating in so-called endemic foci, as claimed by various authors, are only localised manifestations from one common source and that in Central Asia the virus is constantly kept alive among various species of susceptible rodents".

Let us now turn to a discussion of the modes of transmission :

(*a*) From animal to animal;
(*b*) From animal to man.

---

[1] Transactions of the Fifth Biennial Congress, Far Eastern Association of Tropical Medicine, 1923, pp. 305-340.

[2] Wu Lien-Teh, *Jap. Med. World*, 1924, Vol 4, p. 7.

A. *Transmission from Animal to Animal.*

A clear distinction should be made between :

(*a*) Transmission from diseased animals to their contacts; and

(*b*) Spread of infection from one settlement to other settlements.

(a) *Transmission from diseased animals to their contacts.*

So far as spread of the disease from infected animals to their mates is concerned, definite information can only be obtained from a few areas.

CcCOY[3] has satisfactorily demonstrated the important rôle played by fleas (*Ceratophyllus acutus* Baker) and lice (*Haematopinus columbianus* Osborn) in the spread of plague among Californian ground squirrels.

Our own researches in Manchuria have also definitely established that the ectoparasites of the tarabagan (flea and louse) are capable of transmitting infection from one animal to another. In this connection I may state that for several years we have had reason to suspect the intermediate rôle played by the tarabagan flea (*Ceratophyllus silantievi* Wagner) in plague transmission. In addition to the presence of plague-like bacilli in the body of the flea obtained from a naturally-infected tarabagan[4], SUKNEFF succeeded in 1923 in transmitting plague infection through crushed fleas to guinea-pigs[5]. The actual transmission by living fleas was not satisfactorily demonstrated until the summer of 1924 in the Chinese Laboratory at Manchouli, when we obtained positive results in a guinea-pig after exposure to the bites of five *ceratophylli* recently removed from a plague-infected tarabagan[6]. Regarding the tarabagan louse (*Linognathoides citelli* Cummings), similar positive findings have been reached by Sukneff, ourselves and JETTMAR[7], from experiments upon sisels (*Spermophilus evermanni*, Brandt) as well as guinea pigs.

(b) *Spread from settlement to settlement.*

As may be gathered from above, the transmission of plague through the parasites of wild rodents has been proved in at least two areas. Similar results may be expected by investigators working in other parts of the world. Little, however, seems to be known with regard to the perpetuation and spread of plague in wild rodents. This may be illustrated by theories held about the tarabagan, upon which much work has been accomplished by Chinese and Russians. Many Russian scien-

---

3 *U.S. Public Health Bull.*, No. 43, April 1911, pp. 41-51.
4 Sukneff, *Publ. of Harbin Med. School*, 1922, I, pp. 213-234.
5 Sukneff, *The Transbaikalian Endemic Area in* 1923, Chita, 1924.
6 Wu Lien-Teh, Chun and Pollitzer, *Am. Jour. Hyg.*, 1925, Vol. 5, pp. 196-201.
7 *N. Manch. Pl. Prev. Serv. Rep.*, 1923-24, IV. pp. 231-234; Z. f. *Hyg. & Inf. Kr.*, 1925, Vol. 104, pp. 551-568.

tists, like Podbjelski[8], Dudchenko[9], Tchausov[10], Sukneff[11], while acknowledging the important rôle played by the tarabagan in the immediate causation of human plague, seem disinclined to admit that the virus is permanently kept alive in this animal. There was a time —as alluded to in my last paper[12]—when plague was supposed to have been regularly imported by pilgrims passing through the district of Weichang in North Chihli, where plague was believed to be endemic. As I said then, although Zabolotny was able to bacteriologically confirm the disease in 1898, no plague case has been reported for 25 years by our Chinese medical officers stationed in that region. For this reason alone, this pilgrim theory cannot be upheld. Now comes another, advocated by Sukneff (1924), according to which the reservoirs of plague are not the tarabagans but certain species of small rodents, especially the hamster and the rat hare (*Ochotoma daurica*). He gives three reasons for this belief :

(i) The tarabagan does not suffer from chronic plague;
(ii) Only healthy animals hibernate, whereas sick ones remain outside and die off;
(iii) The tarabagan does not migrate and therefore does not spread the disease as in the case of small rodents.

In my opinion, the above reasons are rather far-fetched. It is true that insufficient attention has hitherto been devoted to the smaller rodents and that the presence of plague in them, if any, may have been overlooked. Still, if these small rodents did really suffer from severe and constant epizootics, we should at least have some epidemiological evidence to support this. For example, small rodents inhabit burrows in closer proximity to human settlements than the tarabagan, and any sick ones present would be caught by dogs, cats and children. The infection would also pass to man through domestic rodents and thus be propagated. Nevertheless, only one outbreak out of 60 investigated by us is on record, where *possibly* a dead hamster brought in by a cat might have been the cause of two human cases in a household (Matsievskaja, 1919[13]). Again, with the exception of a few incompletely studied outbreaks, practically all the sixty outbreaks compiled by us could be definitely traced to tarabagan hunting or contact with their skins. Moreover, no outbreak has ever *started* in winter, the small rodents as a rule not hibernating.

Passing now to the problem of *chronic plague* in tarabagans, we have in the past supplied ample evidence of its existence in laboratory animals, while in our list of naturally infected animals three out of 18 showed distinct subacute changes.

---

8 *Russian Archive f. Path, etc.*, 1901, Vol. 12, pp. 249-265.

9 *Vj. Obst. Guigieny*, 1909, pp. 897-909 & 1045-1089.

10 *Russki Vratch*, 1911, Vol. 10, pp. 1004-1009 & 1036-1039.

11 Sukneff, *The Transbaikalian Endemic Area in* 1923, Chita, 1924.

12 Transactions of the Fifth Biennial Congress, Far Eastern Association of Tropical Medicine, 1923, pp. 305-340.

13 Jettmar, *Jour. Transkaik. Med. Soc.*, Nov, 1922, pp. 1-13.

Regarding *hibernation*, there may be displayed some discrimination between sick and healthy animals, but as has been proved by our experiments, tarabagans suffering from chronic plague hibernate in much the same way as healthy ones. In fact, the disease runs a more chronic course during hibernation, making it possible for infection to be carried over the winter.

Migration.—It is generally admitted that as a rule the Siberian marmots do not migrate on an extensive scale, preferring to occupy their underground homes as long as possible. Under extraordinary circumstances, however, as after excessive hunting or scarcity of food due to parching heat, they may leave their habitats for more suitable quarters. So far as we have been able to ascertain, epizootics are usually limited in area and duration; only in certain years are they widespread. It is quite probable that a close association exists between tarabagan disease and dry summers. Support for this belief comes from South Russia, where mice[14] and susliks[15] have been seen to migrate on account of unusually dry weather. However, this matter, especially in the case of tarabagans, needs further investigation.

We may now deal *ad seriatim* with other areas where wild rodents, sometimes alone, sometimes associated with domestic rodents, are concerned in the spread of plague.

California.—McCOY has experimentally demonstrated that squirrel fleas could transmit plague to rats. This method of spread has been observed in actual outbreaks. Regarding the recent Los Angeles epidemic (1924-1925), DICKIE says that "observations over a long period of time have conclusively proven that rats and ground squirrels live in intimate contact, frequently occupying the same burrow, also that rat fleas infest the ground squirrel, as do the ground squirrel fleas infest the rat"[16]. Dickie apparently believes that the human outbreak was due to the rats, the squirrels being only incidentally infected. Considering that Californian squirrels had been regularly observed to be infected since 1903, and as late as 1924 infected squirrels had been found around the Los Angeles district[17] and were still evident during the outbreak (March 1925), it is difficult to avoid the impression that the squirrels are the real originators of the plague though the rat may now and then perform the distributing task. In this respect the Chief Medical Officer of the British Ministry of Health in his report of 1924 appears to be of the same opinion[18].

South Africa.—Among the various rodents and carnivora suffering from plague, MITCHELL[19] points out the interesting stages through which

---

14 Stepanoff, Transactions of the 1924 Saratov Conference, p. 24.
15 Lebedeff, Russki Vratch, 1912, pp. 2087-2089.
16 Dickie, Rep. of Plague Eradicative Measures for the Month of June, 1925, p. 8.
17 *Health* (Melbourne), 1925, Vol. 3, p. 64.
18 On he State of the Public Health, London, 1925, p. 84.
19 Public Health Report for Year ended June 30th, 1923.

the disease passed, namely, from the rat to the striped mouse (*Arvicanthus pumilio*) and again from this to the gerbille, which now acts as the main reservoir. Another observer, HAYDON[20], in laying additional stress upon the activities of the gerbille as a plague-carrier, refers upon its unusual fertility and social inclinations, visiting every burrow within a thousand yards during the course of one night. When sick its potential power for spreading infection is thus evident, and this, in Haydon's opinion[21], is accomplished, not *per saltum*, but by continuous slow stages in which gerbilles and multimammate mice may be found dying in large numbers in an irregular line. On the other hand, the spring hares, travelling 20 to 40 miles in a single night, have also been known to be attacked and therefore may spread the epizootics by long-distance sprints[22].

South Russia.—In this region only the susliks (sisels) and mice (wild and domestic) are of epidemiological importance. In past years *Spermophilus rufescens* was considered the main plague reservoir, but later investigators seem to lay more stress upon the mice which are frequently found in the southern sandy stretches together with *Spermophilus rufescens*[23]. Further northwards the *Spermophilus musicus* (small suslik) and in the Ural district *Spermophilus mugosaricus* and mice are the main distributors of plague. Owing to the susliks hibernating early in the season, they can only be held responsible for the summer outbreaks, whereas the winter outbreaks are caused by mice. It is not yet clear how interrelated are the epizootics among susliks and mice; possibly the disease may pass from one species to the other through the fleas. NIKANOROFF, who has been working upon this problem in South Russia, informed me in a personal communication that the fleas found on *Spermophilus musicus* and *Spermo. mugosaricus* are mainly *Ceratophyllus tesquorum*, while those on the mice are *Ceratophyllus* (Londinensis) and *Ctenopsylla musculi.*

B. *Transmission from Animal to Man.*

This may be effected in four ways :

(i) Direct contact through wounds or abrasions in man;

(ii) Indirect contact through bites of parasites;

(iii) Through other wild rodents taking an intermediate part;

(iv) Through domestic rodents and other animals playing an intermediate part.

Modes (i) and (ii) have been encountered by us in the case of the tarabagan, which is much hunted for its fur, fat and meat. Should the animal be infected, it is quite easy to conceive the virus entering the human system directly through any abrasion or wound during the skinning process. On the other hand, the fur of the animal almost always

---

20 Proceedings of the Transvaal Mine Medical Officers' Assoc., 1924, Vol. 3, No. 12, pp. 4-17.

21 *Lancet*, 1921, II, p. 1104.

22 Mitchell, Report for Year ended June 30th, 1924.

23 Nikanoroff, Saratov Conference, 1924.

harbours ectoparasites (fleas and lice), through whose bite plague can be easily transmitted indirectly to man.

In South Russia the susliks are among the worst pests of crops, and periodical attempts are made by the people to exterminate them. This work entails considerable danger when the animals are infected, and the first victims of a plague outbreak are frequently the persons detached for this work. That suslik fleas can bite man has been shown by ARISTARKHOVA, DENISOVA and others[24].

From South Africa reports constantly occur of persons being attacked by plague while staying in the fields or handling carcases of wild rodents.

(iii) In this connection the multimammate mouse, living naturally in the fields but often penetrating into yards and human dwellings, serves as a connecting link between gerbilles and man in the propagation of plague.

(iv) Examples of domestic rodents playing an intermediate part may be found in South Russia, where the domestic mouse conveys infection from the wild rodents to man. Strange to say, ordinary rats caught thereabouts have seldom been observed to carry the disease[25].

ECONOMIC IMPORTANCE OF WILD RODENTS.

In certain parts of the world, particularly tropical and semitropical countries like India, Hongkong, etc., the domestic rat plays an indispensable rôle in the causation of human plague. In others, like South Africa, South Russia, Transbaikalia and Mongolia, naturally plague-infected wild rodents are constantly present in the fields, where the inhabitants are obliged to carry on their occupation and thus be exposed. A few areas deserve special attention :

South Russia.—Here the inhabitants are often in close contact with wild rodents. During spring and summer attempts are made to destroy the susliks, which, if infected, may be a considerable danger to the people. Moreover, the cattle are often led by farmers to graze in the infected areas. A particularly risky time comes when harvesting of the kumarchik (wild oats) takes place[26]. While handling haystacks, infected mice have frequently been discovered hidden among them.

Turkestan.—A localised outbreak due to collecting of millet has already been mentioned earlier in this article.

Transbaikalia and Mongolia.—In these regions the presence of tarabagans constitutes a most important epidemiological factor. For the animal is used not for play or sport, but forms a principal means of livelihood for large numbers of people. The trade in the skins may run to millions of dollars yearly. Hence the economical factor in the

24 Quoted by Zabolotny, Ann. Inst. Pasteur, 1923, Vol. 37, p. 622.
25 Nikanoroff, *Rev. Microbiol* and *Epidem.*, Saratov, 1922, pp. 71-72; Stepanov, Saratov Conf. Rep., 1924, p. 26.

case of the tarabagan is closely associated with the plague problem. Of secondary importance is the fact that many of the inhabitants stay for days out in the fields while harvesting and are thus exposed to possible infection. One epidemic has been reported in 1920 as having arisen in this way[27].

It is quite likely that similar conditions to those of Transbaikalia and Mongolia prevail in other regions of Central Asia.

METHODS OF CONTROLLING PLAGUE IN WILD RODENTS.

Two methods are possible :

(*a*) Direct means of destruction,

(*b*) Indirect measures.

A. *Direct Means of Destruction.*

A short summary of the measures hitherto adopted in different parts of the world may be of interest.

California.—Soon after the existence of plague in ground squirrels was proved by the American authorities (August 1908), extensive measures of eradication were started. At first these were enforced over the whole State, but when it was ascertained that plague was confined to nine counties of Central California, the campaign was directed only to these infected areas, leaving a squirrel-free zone around the large cities, so as to prevent the infection from spreading to the rats. Statistics recorded by Long[28] show that, for the period July 1st, 1913—November 1914, 3,100,000 acres were treated, resulting in a reduction of squirrels by 90 to 95 per cent. He further added "that on the actually infected and immediately adjoining land, a much higher percentage of squirrel destruction has been obtained, squirrels having been reduced to the point that hunters must cover 26 acres of land in order to obtain one squirrel". Altogether 20 million squirrels were destroyed. Beside shooting, barley mixed with strychnine and carbon bisulphide were used, the former during the dry months. The cost of eradication averaged 17.4 cents per acre. Long reported that the squirrels were almost exterminated, particularly those infected, which fell from 3 per cent in 1912, to 0.30 per cent in 1914. From an economical standpoint, such an eradication was also beneficial to the crops which the squirrels tended to destroy. After estimating the savings to each person at $201.81[29], Long concluded (November 1914) that "it is believed that the statement can safely be made that all discoverable plague has been eradicated from the State of California and that danger of its further spread has been removed". The local authorities, however, soon discontinued the work on the plea of expense. That Long's forecast was rather premature can be seen from the following data compiled by PERRY[30] :

---

26 Nikanoroff, Paper read at the International Malaria Conference, Saratov, 1924; Saratov Conf. Rep., 1924, pp. 92, 113.

27 Jettmar, *Jour. Transbaik. Med. Soc., Nov.* 1922, pp. 1-13.

28 U.S. *Public Health*, Nov. 20th, 1914, Vol. 29, pp. 3103-3107.

29 *Ibidem*, 1914, Vol. 29, pp. 3317-3321.

30 *Ibidem*, 1924, Vol. 39, p. 204.

Nine originally Affected Counties.

County.	*Date of last case of squirrel plague*	*Date of last case of human plague.*
Contra Costa	June 6, 1923	July 13, 1915
Alameda	July 8, 1922	June 29, 1922
San Joaquin	May 17, 1920	Sept. 18, 1911
Stanislaus	June 18, 1920	—
Santa Clara	June 29, 1920	Aug. 31, 1910
Santa Cruz	Sept. 27, 1922	July 18, 1922
Monterey	June 16. 1920	—
San Benito	May 26, 1921	June 8, 1921
Merced	May 15, 1920	—

Other Infected Localities revised to Date.

City.	*Date of last case of squirrel plague.*	*Date of last case of rat plague.*	*Date of last case of human plague.*
San Francisco	May 21, 1917	Oct. 23, 1908	Aug. 18, 1923
Oakland	Sept. 4, 1919	Dec. 1, 1908	Sept. 10, 1919
Berkeley	—	—	Aug. 28, 1907
Los Angeles (16)	March 23, 1925	June 25, 1925	Jan. 11, 1925
Santa Cruz	May 5, 1920	—	—
County.			
Fresno	Oct. 27, 1911	—	—
San Luis Obispo	Jan. 29, 1910	—	—
San Mateo	June 23, 1920	—	—
Los Angeles (16)	Feb. 16, 1925	May 16, 1925	—

The number of human plague cases was never high in California, but two pneumonic outbreaks, one in 1919 (13 pneumonic cases) and one in 1924-1925 (33 pneumonic cases), both probably of squirrel origin, show how serious the problem has become in that American State. Even with the abundant resources at the command of the United States, it seems problematical if the eradication of the ground squirrels can be carried out as easily as Long imagined. McCoy (now Director, Hygienic Laboratory, Washington) stated in 1921[31]: "The magnitude of the problem of exterminating squirrel plague cannot be adequately appreciated without realising that the infection exists in an area at least 150 miles long by 50 miles wide. There have never been sufficient funds available to enable sanitary authorities to deal adequately with it, and the plan of dealing with it through legislative mandate to owners of property which harbours squirrels has not proven effective. It is indeed a serious question whether it is, from the point of view of economy, justifiable to attempt the eradication of squirrel plague, desirable as it may be from some points of view".

[31] *Am. Jour. Hyg.*, 1921, Vol. 1, p. 188.

South Russia.—In South Russia also attempts had been made before the world-war in 1914-1918 to destroy wild rodents on a large scale but without success[32]. At a recent conference held at Saratov in 1924, Traut[33] advocated a strenuous campaign against rodents, giving the following figures of their spread :

District	*Mice*	*Susliks*
	Acres.	*Acres.*
Bukeev Gov.	1,716,000	2,631,200
Kalmuck District	5,720,000	2,702,700
Astrakan Gov.	858,000	858,000
Ural Gov.	858,000	2,002,000
Total	9,152,000	8,193,900

Since the wholesale extermination of rodents was impracticable, he proposed their destruction within the infected areas, and the establishment of a rodent-free belt around these foci. He calculated that altogether it would be necessary to rid the following areas from mice and susliks before satisfactory results could be obtained :

Mice	2,860,000 acres at up to	700 burrows per acre
Susliks	572,000 ,, ,, ,, ,,	1,000 ,, ,, ,,
Total	3,432,000 acres	

Some of Traut's recommendations are quoted below :

(i) For mice, use chemical means (baits with arsenic) and bacteriological methods;

(ii) For susliks, chemical means (either carbon bisulphide or chlorine) and mechanical methods;

(iii) Expenditure, two million gold roubles (£220,000).

Bessonov[34], another speaker at the Saratov Conference, proposed that only foci where epizootics occurred should be early recognised and the rodents exterminated therein. Although palliative in character, he maintained this procedure to be quite as effective and certainly more economical than Traut's method. Other speakers suggested the preservation of foxes and polecats as natural devourers of wild rodents[35], but it is doubtful if the rôle of such animals is of sufficient epidemiological importance[36]. Zabolotny[37] recommended that, if any money were available, it should rather be devoted to the improvement of housing conditions of the population. The general trend of the Conference seemed to be against Traut's grandiose scheme.

---

32 *Lancet*, 1913, II, p. 1576.
33 *Report*, pp. 101-103.
34 *Report*, pp. 103-107.
35 Utegenov, *ibid.*, p. 44.
36 Lebedeff, *ibid*, pp. 98-101.
37 *Ibid.*, p. 110.

South Africa.—Ever since plague was first detected among wild rodents, these have been killed as far as possible within the infected areas. The methods adopted are: Gassing with carbon bisulphide or with agricultural dynamite, and poisoning with barium carbonate mixed with monkey-nuts. Though successful on a limited scale, their utility on a large scale has yet to be proved. In all cases the co-operation of the population with the authorities is essential. The need of conserving natural foes of rodents like birds, wild cats, etc., is also important, so as to maintain the "balance of nature".

French West Africa.—Here a campaign against wild rodents is merged into the general anti-rat campaign.

Transbaikalia and Mongolia.—We now pass to regions with which we are more familiar, namely, Transbaikalia and Mongolia. Here human cases are on the whole rare and usually sporadic, but wild rodents, especially the tarabagan, exist in enormous numbers and form a valuable factor in the sustenance of the people. Whatever hunting is adopted is mainly for purposes of gain, not pure destruction. The smaller species (such as susliks, rat hares, hamsters) are, so far as our experience goes, free from plague and therefore need not detain us. On the other hand, the tarabagan, whose abode is distant from human dwellings, is not a source of danger to mankind until hunted. In discussing methods of control, this should be carefully borne in mind. At the same time, certain general considerations should be remembered.

During the course of an epizootic large numbers of animals may die within a certain locality, but during the next year or so the gaps seem to have been filled up. This may be due to exceptionally favourable conditions of life for the survivors tending to greater proliferation. Or there may have been migrations from other regions, where conditions of life are not so favourable. These factors make one wonder whether any artificial means adopted by man could be more effective than such epizootics as occur more or less regularly. In other words, we believe that permanent results from an eradication campaign can only be obtained if permanent measures are adopted. The moment any laxity or less intensive measures prevail, further breeding will lead to increased numbers. It may be asked: "Is such a permanent campaign possible or profitable, particularly in view of the experience of California, where experts of McCoy's standing question the advisability of continuing the operations?"

Even when the wild rodents, as those in California, South Russia, and South Africa, are veritable pests in their relations with man, it has been impossible to enlist the effective co-operation of the population. Obviously, therefore, a stronger reason exists against hasty measures of destruction in Siberia and Mongolia. Here the tarabagan, besides being non-troublesome and harmless to the only crop (hay), is a real money-getter. Its skin now fetches two roubles (four to six shillings) apiece, and its fat and flesh give additional profit. For four years (since 1921) the Chinese high authorities have prohibited the hunting of the tarabagan

and have confiscated any skins found. Our Plague Prevention Service has not concurred in this view, preferring to control the trade in a scientific way rather than enforce blind prohibition over such vast areas of territory. As we feared, the prohibition has led to illicit hunting of animals and smuggling of skins on an extensive scale. The advantage of scientific control are evident :

(i) The licensed hunters would be under our supervision and would be trained for their trade;

(ii) Should any fall sick they will report and not hide their malady or its origin;

(iii) Skins can be properly stored and disinfected under our supervision;

(iv) A regular income will be received, partly for the support of the local health service.

(v) The economic condition of the neighbouring towns will be enhanced.

It has taken four years to convince our high authorities of the advantages of regulation rather than prohibition, and now finally on September 1st, 1925, the ban against the tarabagan trade has been removed. As a consequence, our Plague Service has recommended certain regulations which are embodied in the appendix to this article.

B. INDIRECT MEASURES.

These vary according to the conditions prevailing in different areas as well as to the financial status of the regions concerned. Only a few salient points need be mentioned here :

(i) Anti-plague detachments, governed by the head anti-plague organisation, with facilities for diagnosis of rodent and human plague, and proper management and demarcation of outbreaks :

(ii) Educational department for providing information by lectures, pictures, pamphlets, exhibits, etc.;

(iii) Rodent-proofing measures, where there exists evidence of communication (direct and indirect) of the wild rodents with human dwellings and stores;

(iv) General improvement of housing conditions and economic status of the people.

SUMMARY.

1. The ectoparasites of wild rodents play a principal part in the transmission of plague from animal to animal and from animal to man. Complete evidence is furnished in the case of Californian ground squirrels and Siberian marmots.

2. Extermination of wild rodents suffering from plague epizootics is a difficult process, even in regions where damage done to crops is considerable. To obtain permanent results, permanent and intensive measures are necessary.

3. Where such permanent results cannot be guaranteed, the advisability of concentrating energy upon indirect measures has to be considered.

4. The tarabagan, being a great economical asset, lies in a class of its own. Consequently, a special plague policy should be adopted in the districts inhabited by this rodent.

APPENDIX I.

LIST OF RODENTS KNOWN TO SUFFER FROM SPONTANEOUS PLAGUE OTHER THAN THE DOMESTIC RAT AND MOUSE.

Name :	Locality :	Reference :
Bandicoot *Bandicota indica* (Nesokia bandicota)	India	Jl. Hyg. 1907, Plague No., p. 760 & 1910, Pl. No., pp. 459-460
Small Bandicoot *Nesokia bengalensis*	,,	Hossack, Jl. & Proc. Asiat. Soc. of Bengal, New Series, vol. 5 (1906)
Bandicota malabarica	Ceylon	Philip & Hirst, Jl. of Hyg., 1915, vol. 15, p. 543
Black Marmot (a)	Semiretchinsk	Russian Public Health Rep., 1907, p. 162
African Bush Rat *Golunda campanæ*	Senegal	Leger & Baury, Bull. Soc. Path, Exot., 1923, vol. 16, p. 136
Cricetomys gambianus Waterhouse	Gold Coast	Graham in Simpson, Rep. on Plague in the Gold Coast in 1908, pp. 21-25
"Cuis" *Cavia aperea*	Argentine	Uriarte & Gonzalez, C. R. Soc. Biol., 1924, vol. 91, pp. 1040-1041
Field Mouse *Arvicola arvalis*	South-East Russia	Damberg & Tikhomiroff, quot. by Koltzov, Vratch. Gaz., 1915, pp. 335-337; Nikanoroff, Vj. Microbiol. & Epidem., 1922, vol. 1, pp. 71-72 and personal information.
Field mouse *Microtus socialis*	,,	Koltzov, Vratchebnaja Gaz., 1917, pp. 147-150
Field-rat	Rhodesia	Kinghorn, 1918, quot. Trop. Dis. Bull., vol. 13, p. 324

"Large Field-rat"	Senegal	Laveau, Bull. Soc. Path. Ex., 1919, pp. 482-484
Field-rat *Arvicanthis niloticus* (b)	Egypt	Egyptian Plague Rep., Cairo, 1923, p. 52
Field-rat *Hesperomys pulustris*	New Orleans	William. Am. Jl. Publ. Health, 1920, November
Field Rodent (Mouse)	Khorassan (Persia)	Grekoff, quot. by Clemow, Lancet. 1913. I, p. 1697 & Guigiena & Epidemiologia, 1924, vol. 3, No. 4, pp. 50-51
Gerbille *Psammomys obesus* Lataste (a,c)	Tunis	Gobert, Arch. Inst. Pasteur de l'Afrique du Nord, 1921, vol. I, pp. 440-446
Gerbille *Tatera lobengulæ*	South Africa	Mitchell, Jl. Hyg., 1921, vol. 20, pp. 377-382 and Haydon, Lancet, 1921, ii, pp. 1103-1104
Namaqua gerbille *Pachuromys auricularis*	,,	Kauntze, Kenya Med. Jl., 1925, v. 2, p. 163
Californian Ground squirrel *Citellus beechyi* Richardson	California	Wherry, Jl. of. Inf. Dis., 1908, pp. 485-506 and McCoy, U.S. Publ. H. Rep., 1908, pp. 1289-1323
Ground squirrel *Geosciurus capensis*	South Africa	Mitchell, Publ. H. Rep. for year ended June 30, 1924
Guinea-pig *Cavia cobaya*	Sydney	Thompson, Rep. of the Board of Health on a second Outbreak of Plague at Sydney 1902
	India	Liston, Jl. Bombay Nat. Hist. Soc., 1905, vol. 16, p. 253 & Jl. Hyg., 1908, vol. 7, p. 891
	Manila	Schoebl, Phil. Jl. of Sc., 1913, vol. 8, pp. 417-421
	Senegal	Noc, Rep. sur le fonct. du Lab. de Bact. de l'A. O. F. en 1919, Dakar, 1920.
Hamster *Cricetus cricetus*	South-East Russia	Koltzov, Zabolotny's Rep. on Plague in South-East Russia, Leningrad, 1926
Hare *Lepus europæus*	England	Martin & Rowland. Observ. on Rat Plague in East Suffolk 1910 & Bulstrode, L. G. B. R., 1910-11, p. 36

Large Jerboa *Alactaga saliens*	South-East Russia	Berdnikov, Zentralbl. f. Bakt., 1913, vol. 69, pp. 251-259
Small jerboa *Alactaga elater*	,,	Koltzov, l.c. (1926)
Jerboa	Baku District	Milman, Russki Vratch, 1915, pp. 351-353 (d)
Karroo Rat *Parotomys luteolus*	South Africa	Mitchell, l. c., 1924
Kirghese mouse *Mus musc. Wagneri*	South-East Russia	Gaiski & Alficnov, Vj. Microbiol. & Epidemiol., 1926, 3, p. 133
Large-eared Mouse *Malacothrix typicus*	South Africa	Mitchell, l.c., 1924
Mole-rat *Cryptomys*	,,	Mitchell, Bull. Off. Internat. d'Hyg. Publ., 1924, vol. 16, p. 570
Multimammate Mouse *Rattus coucha*	,,	Mitchell & Haydon, l. c., 1921
	Uganda	Uganda Protect. Ann. Med. & San. Rep. for 1921, pp. 96-99
	Senegal	Leger & Baury, l. c.
Pelomys fallax iredescens Heller	East Africa	Lurz Arch. f. Schiffs-und Tropenhyg., 1913, No. 17, pp. 593-599
Porcupine *Hydrochoerus capybara*	Mysore (India)	Bruce Low, L. G. B. R., 1898-01, p. 317
Rabbit *Oryctolagus cuniculus*	England	Martin & Rowland, l. c.
Rock rabbit *Procavia capensis*	South Africa	Kauntze, l.c.
Sand mouse *Rhombomys opimus* Licht.	Turkestan	Nikanoroff, qu. by Grekoff, l.c. (1924); Vj. Microbiol. & Epidemiol. 1924, p. 201; personal communication from Pr. Nikanoroff
Sand mouse *Mus (Gerbillus?) tamaricinus* (e)	South-East Russia	Personal communication from Pr. Nikanoroff and Transact. Saratov Conferences, 1924, pp. 39, 93, 113, 1925, pp. 167, 172

Sisel (suslik) *Spermophilus rufescens* *Spermophilus musicus*	South-East Russia	Deminski, quot. by Klodnitzki, Russki Vratch, 1913, pp. 1067-1070; Berdnikov, l. c.
Cynomys (spermoph.) fulvus *Spermophilus mugosaricus*	(Ural Terr.) ,, ,,	Koltzov, l.c., 1917
Springhare *Pedetes caffer*	South Africa	Mitchell, l. c., 1924 (Report)
Squirrel *Sciurus palmarum* (f)	India	Simond, Ann. d'Inst. Pasteur 1898, p. 664
Fonambulus palm.	Ceylon	Colombo Rep., 1922, p. 41
Striped mouse *Rhabdomys pumilio*	South Africa	Mitchell, Jl. Roy. Army Med. Corps, 1906, Vi, p. 130 & Report, 1924
Tarabagan *Arctomys bobac*	Transbaikalia, Mongolia, etc.	Bjeliavski & Rjeshetnikoff, Vj. Obst. Guig., 1895
Tree rat *Mus (Thamnomys) aff. dolichurus* Smuts	East Africa	Lurz, l. c.
Water-rat *Otomys irroratus*	South Africa	Mitchell, Bull. Off. Internat. d'Hyg. Publ., 1924, vol. 16, p. 570
Dusky footed wood rat (brush rat) *Neotoma fuscipes* Baird	California	McCoy & Smith, Jl. Inf. Dis., 1910, vol. 7, pp. 368-373

Remarks: (a) The existence of plague was not definitely proved in these two.
(b) Plague infection has been proved also in the *Arvicanthis abyssinicus* nubilans Wrought, Uganda (Buchanan, Bull. Off. Internat. d'Hyg. Publ., 1925, p. 492.
(c) Besides gerbilles field-rats seem to have been involved.
(d) Plague infection was proved also in some mice (species?).
(e) It is not yet definitely determined to which species this rodent belongs.

Possibly it is identical with the "Gerbillus" found involved in a plague outbreak by Gaiski & Alfionov (l.c.)
(f) One palm-rat was found infected in Senegal (see Laveau, Bull. Soc. Path. Exot., 1919, pp. 291-296).

APPENDIX II.

Proposed Functions of Bureau for Controlling Tarabagan Skin Trade.

1. Bureau to be associated with Manchurian Plague Prevention Service, with P.P.S. Medical Officer as chief medical consultant and executive. Local officials to render all possible assistance in making regulations and laws effective.

2. Principal functions of Bureau :

(*a*) License tarabagan hunters, each person to pay a regular tax.

(*b*) Issue instructions to them to carry on their trade with safety.

Thus—*hunting seasons* to be (1) immediately after hibernation (April-May), (2) in autumn (August-September).

Habits of tarabagans.—Healthy animals are active, can sing and run, while sick animals move with difficulty and are careless. Breeding. Hibernation.

Plague is continually present among the animals, but is usually confined to certain areas, and epidemics occur at certain times of the year. Notices will be supplied by the Bureau as to infected places and dangerous times. Hunters should avoid such dangerous places.

Supervision of modes of living.—Need of wearing gloves and disinfecting hands when necessary.

Methods of trapping, killing and skinning animals to be followed out closely.

Avoidance of indiscriminate killing of young and female ones, so as to prevent exitinction.

Other precautions to be issued from time to time for protection of hunters.

(*c*) Applications from hunters to be passed by Bureau; they must submit themselves to be examined medically. Hunters must report to Bureau before and after return from hunting trip.

(*d*) Bureau to be equipped with proper laboratories, so that suspicious skins, animals or human cases may be examined without delay.

(*e*) Bureau to have proper facilities for receiving and disinfecting skins with latest and best methods. Fixed charge to be made for disinfection.

(*f*) Bureau to keep list of licensed tarabagan skin-dealers and stores.

(*g*) Mounted patrols to be employed for inspecting country where hunting goes on in order to help hunters, see that orders are carried out, prevent smuggling, and detect tarabagan and human plague.

3. If possible, at least two bureaux to be established—one at Manchouli and the other at Hailar.

4. The great tarabagan regions in North Manchuria are those open plains between Hailar and Manchouli, where millions of tarabagans may be found.

5. Since the tarabagans of Transbaikalia are more often infected than those of Manchouli, cordial relations to be established between our Bureau and the Soviet authorities of Transbaikalia for mutual exchange of notes and protection.

APPENDIX III.

Introduction.

Since the article on "Plague in Wild Rodents" was published in autumn, 1925, new information has come to hand regarding certain aspects of this problem, a summary of which is herewith given. Some new species, reported to suffer from natural plague, have been embodied in the Table appended to the foregoing article; other minor additions and changes have been made as well in this Table which is now brought up to date.

Transmission from Animal to Animal.

A welcome addition to our knowledge on this and related problems has recently been made by several studies upon the fleas of South-Russian wild rodents.(1)

The fleas of some rodents suffering from natural plague have been determined as follows:

Citellus musicus	*Citellus mugosaricus*	*Alactaga saliens*
Ceratophyllus tesquorum	Cer. tesquorum	Mesopsylla tuschkan
Ctenophthalmus pollex	Cten. pollex	Ceratophyllus (Ophthalmopsylla) volgensis.
Neopsylla setosa	Cten. breviatus	
	Neopsylla setosa	

Golov and Joff report that of the suslik (*Citellus*) fleas, two species (*Cer. tesqu.* and *Neopsylla set.*) bite man readily, whilst *Ct. breviatus* has thus far failed to do so; the other species have apparently not been tested. Suslik fleas have so far not reliably been observed to live upon man for any length of time.(2)

Golov and Joff succeeded in transmitting plague from infected to healthy susliks with the aid of fleas (mainly *Cer. tesquorum*). Infection occurred evidently during the bite and not through feces. Infected fleas were twice seen to vomit and plague bacilli were found in the vomitus. The feces of infected fleas may contain plague bacilli for a considerable time (as observed up to 79 days at a temperature of 7-10° C. and 92% humidity), though they bit an infected animal only once, and afterwards fed upon healthy ones.

Evidently the suslik fleas do not live constantly on their hosts but dwell partly in the burrows; this holds apparently true of the species *Neopsylla* and *Ctenophthalmus* which possess rudimentary eyes.

Investigations upon the flea rate at different seasons of the year are not yet completed, so far as the numbers found in the nests are concerned. The *total* rate of fleas found on the rodents themselves seems to increase in the course of the summer. Joff and Wagner submit a table

(1) Joff, Proceedings of the Anti-plague Conference, Saratov, 1925, p. 200; Golov & Joff, ibidem, p. 71 & Vj. Microbiol. & Epidemiol. 1925, No. 4, p. 19; Wagner & Joff, ibidem, 1926, No. 1-2, p. 57.

(2) Zabolotny reported at the 1924 Saratov Conference (Proceedings p. 121) that he found both mice and suslik fleas on human beings. Wagner & Joff doubt if the fleas in question were actually collected from human beings.

showing the incidence of the *different species* during the warm months from which we have constructed a diagram showing the percentage of onsets of human epidemics as given by Gaiski.[3] It would be rash to rely too much upon such limited figures. At the same time one may note the parallelism existing between the lines for *Ceratophyllus* infestation and for the onsets of human outbreaks. Comparing this with the role played by the genus *Ceratophyllus* in other parts of the world, one is tempted to believe perhaps that this flea may be the main agent for transmitting plague from susliks to man.

Our contention that in the endemic regions of Transbaikalia, etc. the tarabagan itself is not only the transmitter but also the permanent reservoir of plague has been confirmed by investigations carried out on a large scale upon the susliks of South-East Russia. Here as in Transbaikalia contradictory opinions as to the primary cause of plague exist While some authors ascribe a spontaneous character to the epizootics, others consider a periodical infection of the wild rodents through their devouring of buried human victims. Experiments upon the seasonal susceptibility of the susliks to plague infection performed by Nikanoroff[4] and Gaiski[3, 5] throw new light upon this problem. Thus,

Nikanoroff inoculated every forthnight from June to end of July, batches of 30 susliks with cultures of the same origin and uniform virulence. Four series were made with subcutaneous injection. In the first most animals succumbed quickly to acute plague, while in the other three series the disease displayed more and more a slow evolution. Thirty days after infection there still lived :

In the first group	0
In the second group	5
In the third group	5
In the fourth group	18

Nikanoroff does not draw final conclusions from his work; he remarks that, while suslik holes were found on human graves and the susliks could easily reach the dead bodies, no proof is forthcoming that the rodents actually feed upon them. On the other hand, he furnishes data to support the spontaneous character of the epizootics, and states that when once plague is introduced among the susliks it shows no tendency to disappear. In spring and early summer, when the susliks are most susceptible to infection, an epizootic of an acute character prevails, which kills many though not all. On the contrary the disease assumes a more or less chronic character, some animals becoming carriers, and thus infection may be carried over the whole period of hibernation. When spring approaches, the susliks, weakened by long abstinence from food, are again susceptible to acute infection.

---

(3) Gaiski, Vj. Microbiol. & Epidemiol., 1926, No. 1-2, p. 3.
(4) Vj. Microbiol. & Epidemiol., 1925, No. 3, p. 34.
(5) Transactions, 1925 Saratov Conference, p. 63.

This conception of Nikanoroff is confirmed by the experiments of Gaiski undertaken throughout a whole year. He infected subcutaneously 242 susliks in 27 batches, using for each new series a strain isolated from the preceding. Seasonal differences were noted in two directions :

(*a*) The mean length of illness varied, reaching its minimum (3 days) in June and its maximum (25 days) in winter.

(*b*) While in June and July 100% of the animals displayed bacteraemia, only 60% were so found in winter and 40% in March. The other animals suffered either from purely local plague with bacilli only at the site of infection, or from transitory forms (bacilli in the organs but not in the blood). The maximum of cases with 'local plague' was reached in winter (30%).

Specially interesting are the animals infected while hibernating. Of 30 such animals :

awoke and succumbed after 2-22 days (average 8 days)	21
were killed (15 & 35 days after infection respect.)	3
succumbed after 45-138 days	6
Total	30

Discussing the fact that the majority of his animals awoke after infection, Gaiski points out that the same may take place under natural conditions and that the finding of plague-infected animals above ground after onset of hibernation might be explained in this way [6].

Of the three animals killed, two (15 & 35 days after infection respectively) were well nourished and showed plague bacilli only at the site of infection but not in the blood or organs (cultures and experiments).

Of the three animals dying after 138, 120 and 96 days respectively at the physiological end of hibernation, at least one had passed through a stage with bacteraemia so that it was possible for its fleas to spread infection.

Gaiski suggests that the perpetuation of plague among the susliks without their dying out wholesale is due, not so much to a gradually developing specific immunity as to seasonal changes of susceptibility to infection. Like Nikanoroff he concludes in favour of plague infection being perpetuated throughout the seasons by susliks. Plausible as such a role of the small susliks may be on account of these investigations, their principal importance is not universally acknowledged. Thus

---

[6] In this connection may be mentioned a report by Jeftichev (Guigiena & Epidemiologia, 1925, No. 3, p. 75) : A limited plague outbreak occurred in the district of Turga (Transbaikalia) in October, 1924, i.e. at a time when the tarabagans were already hibernating. Nevertheless the human cases were evidently of tarabagan origin, due to the skinning of one corpse, from which an eagle had been chased away. Jeftichev was told by the natives that tarabagans, beginning to hibernate but falling sick with plague, are apt to leave their holes again.

Klodnitzki[7] again claims recently that not the small sisels but a species of larger rodents, the *Cynomys fulvus* is the real reservoir of plague from which the sisels and other animals become infected from time to time. The systematic studies of Nikanoroff and his school leave little doubt that plague is perpetuated among the small susliks.

METHODS OF CONTROLLING PLAGUE IN WILD RODENTS.

South Russia.—In our original article mention was made of two methods recommended for the destruction of the wild rodents at the 1924 Saratov Conference: Traut considered their wholesale destruction within and near the infected areas technically and financially possible, while Bessonov proposed a palliative method (early recognition of foci and extermination of rodents therein).

In 1924 attempts were undertaken to prevent human plague by a scheme similar to that suggested by Bessonov[8]. Through a systematic survey covering a large territory and undertaken by six detachments early in spring the presence and extent of suslik plague was established. In two localities which appeared much threatened the following measures were adopted at once:

(*a*) Vaccination of population
(*b*) Educational campaign
(c) Creation of rodent free belts, 2 versts wide, round the villages.

(*a*) Vaccination was carried out in one of the areas only and was not very popular. Still, the *comparatively* high number of volunteers gives hope that in future it may be practised on a larger scale.

(*b*) The population was instructed by distribution of leaflets, lectures and similar means. The people paid much attention to the problem of plague and observed the recommended precautions.

(c) The scope and results of the direct fight against the susliks is shown by the following table:—

Locality:	Acreage treated:	No. holes treated:	Result:
Kalmuck and Don Territ. (Zavjetnoe etc.)	13,241.8	623,000	One human case occurring at time when work was handed over by health authorities to agricultural experts.
Kalmuck Terr. near Astrakhan Gov. (Burata etc.)	2,616,90	170-250 per acre	No human case.

Nikanoroff emphasizes the excellent results obtained in these areas where plague is endemic. He further points out[9] that in 1925, when measures against the susliks could not be started immediately after plague

(7) Guigiena & Epidemiologia, 1926, 1, p. 43.
(8) Nikanoroff, Guigiena & Epidemiologia, 1925, No. 1, p. 74.
(9) Transactions of 1925 Saratov Conference pp. 21, 32, 41.

was detected and the population was in closer contact with the susliks than before (hunting them for their skins and meat), human cases occurred at different foci. In one locality where an energetic campaign was begun immediately after sick rodents had been found, an epidemic was averted(10).

At the 1925 Saratov Conference some speakers entertained doubts if the above mentioned method was sufficient or even reasonable. Traut (11) went so far as to suggest that the non-appearance of plague in 1924 was not due to the anti-suslik campaign but a mere coincidence, as in other localities where infection had been proved among the rodents, no human cases followed though no steps were taken. To the unbiassed it would seem that the methods used are of some value. Certainly contact with the rodents may occur outside the belts created; on the other hand the detachments do not merely destroy the rodents, but offer free vaccination, enlighten the population as to the danger of the epizootics and their prevention, etc. To us a more serious question lies in the difficulty of finding sufficient money and co-operation to continue this work. The experiences of 1925 are not promising in this respect. Certainly not much help can be expected from the population. Under these circumstances another scheme proposed (12) at the 1925 Saratov Conference deserves notice. This suggests in addition to the palliative measures extermination of rodents in localities where natural boundaries prevent reinfestation by immigration.

California: A scheme for complete eradication of wild rodents in suitable localities as contemplated for South Russia has actually been carried out in combating the 1924-25 epizootic in the Los Angeles County:

Whenever squirrel plague occurred, the surrounding country was surveyed in order to discover the natural boundaries or "squirrel barriers", confining the spread of rodents in such an area (built-up properties, streams, areas unsuitable for the squirrels, etc.). Starting from the focus of infection and its immediate vicinity, destruction is carried out within this whole area. A repopulation of such localities surrounded by "squirrel barriers" is impossible and hopes are entertained that the squirrels have been completely eradicated within the infected areas ((13). The results of this far-reaching program deserve to be watched with interest.

Disinfection of skins:

We have mentioned already that, owing to changed economical conditions, far more extensive hunting of the South Russian susliks is now indulged in than before. Naturally therefore the question arises whether and how far a disinfection of their skins is indicated. An

(10) Bessonov, ibid., p. 190.
(11) Ibidem, p. 133.
(12) Traut, l.c. & Resolutions, pp. 250-252.
(13) Ryan, Paper read at the Annual Conf. of Calif. Health Off., Oct. 1, 1925; Dickie, Rep. on Pl. Eradicative Measures, Los Angeles, 1924-25.

investigation in this matter was undertaken by Gaiski[14] who from a small number of experiments reaches the following conclusions :

1. The plague bacillus dies on suslik skins kept in the usual stores in less than three days in summer.
2. When exposed to the sun during hot summer weather the bacillus succumbs on the skins in less than six hours.
3. Human infection results from contact with living or freshly killed animals.
4. Disinfection of dried suslik skins is superfluous.

In the discussion on Gaiski's paper stress was laid upon the small scope of his experiences and upon the necessity to continue further researches. One of the schemes contemplated is to quarantine the skins for 2½ or even for 4 months before releasing them for sale.[15].

We are certain that Gaiski's conclusions cannot be applied with safety to tarabagan skins. We have ourselves seen some of the parasites (lice, ticks, and even some fleas) remain on skins which have been dried, folded and piled up. Furthermore, there is no guarantee that the hunters dry the skins properly; this may be prevented by bad weather. Some hunters even dislike to expose their pelts to the sun, for fear of melting the subcutaneous fat, which might damage the fur and thus depreciate its value [16]. There is no doubt that prolonged storage under proper conditions would render the skins innocuous, but such a scheme would be impracticable so long as the trade in skins lies in private hands. For these and other reasons most experts agree upon the necessity of disinfection, and this has been adopted by the authorities in Manchuria and Transbaikalia.

An investigation on the disinfection of tarabagan skins in Transbaikalia was recently undertaken by Skorodumoff [16]. He found the disinfecting chamber at Borzia[17] where the permanganate-formalin method was adopted, insufficient : skins of plague infected guinea-pigs were found to still contain *B. pestis*, after having been exposed in the chamber; plague cultures, bed-bugs, fleas, lice and ticks were alive after exposure. Good results were obtained in the steam-formalin chamber at Kiachta if a temperature of 60°C. was maintained for one hour. At temperatures of 52-56°C. plague cultures were not killed in an hour, and positive results were obtained from the exposed skins of infected guinea-pigs and mice. The quality of the furs was apparently not impaired by the disinfection.

---

(14) Transactions of 1925 Saratov Conf., p. 164; Vj. Microbiol. & Epidemiol., 1925, 4, p. 15.

(15) Transactions of 1925 Saratov Conf., pp. 33, 166.

(16) Skorodumoff, ibid., p. 237.

(17) This chamber has a capacity of 169 cubic metres. For disinfection were used 5 litres of formalin, the same amount of water and 5 kilogram of Sodium Permanganate. Length of exposure "some hours."

Suvorov's [18] experiences (South-East Russia, 1926) with the use of chlorine and carbon bisulphide for disinfecting and disinfesting plague huts, skins, furs, etc. (*when quite dry*) seem promising. It remains to be seen, however, if these methods can be applied for commercial purposes.

Perhaps the safest way for dealing with the disinfection and storage of both suslik and tarabagan skins would be by means of an efficiently administrated Government monopoly, which would receive the skins from the hunters directly, disinfect, store and then sell them under proper supervision. The advantages of this scheme are obvious :—

a. Efficient control of the hunters who would be automatically in touch with the Government organ.

b. The trade through middle parties and storage of skins in their insanitary quarters would be avoided.

c. Any profit accruing would be devoted to the benefit and protection of the hunters and administration, who really accomplish the work.

Postscript: Recent investigations on South African wild rodents by Pirie & Ingram (Bull. Off. Internat. d'Hyg. Publ., 1926, p. 914) emphasises the epidemiological importance of the *Tatera lobengulae, Rattus coucha and Geosciurus capensis* in the mountainous regions as compared with that of *Rhabdomys pumilio* in the lowlands. The Karroo rat and possibly the springhare deserve less attention because their infesting fleas are entirely different from those of the above mentioned species. Infection could be transmitted from diseased to healthy animals with the aid of the *Dinopsyllus lypusus* and *Chiastopsylla rossi*. Whilst the fleas are undoubtedly the main agents in the spread of the disease among gerbilles, the latter's habit in devouring their sick mates also seems of epidemiological importance.

The investigations undertaken so far speak against continuation of the disease among the rodents themselves, and it is suggested that the *burrows,* which according to the experiments undertaken may remain infectious for more than six months but less than a year, serve as reservoirs of plague. Investigations in this direction were performed with flea-free animals; the burrows used were also said to be free from fleas.

Among the gerbilles, an epizootic caused by a new bacterium belonging to the *B. diphtheriae* group was detected near the Tiger river. This "Tiger-river bacillus" is highly pathogenic to gerbilles and other small rodents but harmless to rats and larger mammals (dogs, cats, monkeys). Hopes are entertained that this strain may be profitably used for the extermination of small wild rodents.

WU LIEN TEH

(18) Vj. Microbiol. & Epidemiol., 1926, vol. V, No. 3, p. 143.

REMARKS ON THE COEXISTENCE OF TUBERCULOSIS AND PLAGUE, AS STUDIED ON MIXED INFECTION IN GUINEA PIGS.

Reprinted from the National Med. Jl. of China, Vol. XI, No. 4, 1925.

In former times the views concerning the influence of different kinds of diseases on the course of a plague infection were not the same as nowadays.

Many people believed that recovering from another sickness more or less preserved them from plague infection.

Especially smallpox (Vally, quoted after Clot Bey) and syphilis were regarded as very effective in this respect.

Thus, during the great plague in London (*anno* 1665), people tried to secure themselves against plague by infecting themselves with syphilis (Haeser, quoted after Müller-Poech). But soon it became evident that these diseases are by no means able to protect the organism against a subsequent infection with plague.

Numerous post-mortem findings proved the coexistence of plague and all sorts of diseases, while the latter cannot provide any protection against subsequent plague infection.

Thus people having infected themselves with syphilis during the great London plague succumbed to the pestilence earlier than non-syphilitics (Haeser). Recovery from typhus has no influence on the course of a later plague infection (Griesinger). At the plague hospitals in Bombay numerous patients with pock marks were observed, etc.

Numerous post-mortem findings proved the coexistence of plague and most different infectious diseases, the plague on the one hand penetrating into an already infected organism (for instance, malaria, filariasis, smallpox, syphilis, etc.) on the other hand promoting or at least not disturbing the invasion of any other pathogenic germs (for instance, streptococcal or pneumococcal infections.)

The pathologic-anatomical material, collected by Albrecht and Ghon, shows the comparatively frequent presence of mixed infection in plague. More than one third of their cases relate to mixed infection.

The influence of some pathogenic germs on plague bacilli and vice versa has been investigated already on some species of bacteria. Thus, for instance Lustig and Galeotti stated that the virulence of the plague bacillus is weakened, if growing together with another bacterium (staphylococcus); while, according to Gotschlich, molds have no influence on bacillus pestis even when cultured together for seven months in the same medium.

Albrecht and Ghon, studying the histological changes in a case of mixed infection of plague and streptococcus, had the impression that the plague bacilli had been choked and their development delayed.

The same authors showed in vitro that the metabolism of the bacterium coli and the staphylococcus pyogenes aureus had no influence on the growth of the plague bacillus.

Very interesting results are obtained by W. Goss, who made a special study about the mixed infection of bacillus pestis and pneumococcus. He stated that an infection with plague promotes the development of pneumococci in the body of guinea pigs and can change a nonfatal pneumococcal infection into a fatal one.

There are also numerous clinical and pathologic-anatomical observations about the coexistence of tuberculosis and plague. Thus the German Plague Commission stated that acute tuberculosis promotes the spread of plague in the lungs. This commission reports that just in foci of tuberculosis in acute as well as in healed areas the plague bacillus finds a favorable medium for its establishment. The statements of this commission are based not only upon several post mortems, but also upon the well-known statistics at Bombay verifying the fact that in plague epidemics the mortality of tuberculosis corresponds with that of plague. Also Albrecht and Ghon and subsequently many other authors stated the simultaneous coexistence of tuberculosis with plague.

Although tuberculous changes were found in numerous plague corpses, as far the author knows,* further *histological* details have not been studied until now. In the medical literature there are only a few references. Thus Albrecht and Ghon describe the coincidence of bac. tuberculosis and plague in a lymphatic gland of the trachea. This gland showed numerous tubercles formed by epitheloid cells showing widespread caseation, sometimes with regular giant cell systems. Isolated tubercle bacilli were seen in them. Between these tubercles there were small sinuses containing numerous polynuclear leucocytes and plague bacilli. In another case, these authors describe a deep inguinal gland with the characteristics of a secondary plague bubo showing tuberculous changes. The sinuses of this gland were filled with plague bacilli; besides, scattered nodules were to be found there showing all the features of tubercles. Describing another lymphatic gland of the same case (from the right inner femural ring) these authors refer to numerous tubercles, surrounded by a broad belt of plague bacilli. Numerous tubercles were found likewise in the peritoneum of this case, which was complicated by a chronic malaria infection besides.

At the International Plague Conference at Mukden (April, 1911), Professor Fujinami stated that in the tuberculous areas of pneumonic

(*Continued on page 58*).

* Of some original papers, only brief reports were obtainable.

TABLE I.

GUINEA PIG NO.	MODE OF TB-INOCULATION	NO. OF DAYS BETWEEN THE 2 INFECTIONS	MODE OF PLAGUE INFECTION
1	Sputum with 20-50 Tb-bacilli in every range of vision introduced into an artificial recessus in the skin of the abdomen.	18	Rubbing the plague culture into the Tb-ulcer of the skin on the abdomen immediately after lifting off the scab.
2		30	Cutaneous inoculation rubbing the plague culture into the shaved skin near the walls of the Tb-ulcer.
3	Tb-culture introduced into an artificial recessus in the skin of the abdomen.	36	Cutaneous inoculation like No. 2.
4	Like No. 3.	36	Cutaneous inoculation like No. 2.
5	Emulsion of a Tb-culture injected into the ventricle of the heart.	11	Injection into the ventricle of the heart.
6	Like No. 5.	11	Like No. 5.
7	Emulsion of a Tb-culture injected into the peritoneum.	23	Cutaneous inoculation into the shaved skin of the abdomen.
8	Like No. 7.	23	Like No. 7.
9	Subcutaneous inoculation of a Tb-culture.	23	Inoculation from the dorsum between the scapulæ into the lung tissue.
10	Like No. 9.	23	Like No. 2.
11	Tb-culture emulsion injected intra peritoneum.	8	Intraperitoneal inoculation.
12	Like No. 11.	8	Subcutaneous inoculation.

DEATH AND MANNER OF DEATH AFTER ? DAYS	OBSERVATIONS, RESP. SHORT DESCRIPTION OF THE PATHOLOGIC ANATOMICAL FINDINGS
	Killed 16 days after plague infection. Typical Tb-changes in the organs. No signs of plague (smears, cultures B. pestis negative).
Killed in the agonal state of the sickness 4 days after plague infection.	Hemorrhagical primary bubo in inguine showing caseated areas. Enlarged spotted spleen. B. pestis in smears and cultures.
Like in No. 2 : 4 days	Great caseated inguinal bubo with hemorrhagical walls. Enlarged spotted spleen. B. pestis in smears and cultures.
4 +	Like No. 3.
4 +	Liver and spleen spotted by numerous necrotic foci; mediastinitis. Plague in smears and cultures.
4 +	Like No. 5.
On the 6th day	Primary inguinal bubo, softened tubercles and thickening of the omentum majus. Spleen enlarged with numerous necrotic foci. B. p. in smears and cultures.
6½ +	Big primary inguinal bubo with softened center. Omentum majus is changed into a nodose cord with necrotic foci. Spleen enlarged with numerous necrotic foci.
2½ +	Hepatization of the right upper lobe of the lung, no buboes, spleen enlarged, spotted. B. p. in smears and cultures.
Killed in the agon state, 4 days after injection.	Pathol. anatomical findings as in No. 2.
4½ +	No buboes, abdominal cavity filled with yellow-brownish stringy exudate; numerous hæmorrhages in the serosa of the intestine. Omentum majus thickened; spleen enlarged, spotted.
7 +	Gelatinous hæmorrhagic infiltration of the subcutaneous tissue of the abdominal skin; axillar and inguinal buboes, spleen enlarged with numerous large and small necroses.

(*Continued from page 55.*)

plague lungs he found very few bacteria, and he believed that "this made it clear that it was because the invasion of the lymphatic system of these patients had been interfered with."

Fujinami and Wu (1924) stated that one cervical lymph gland of a pneumonic plague case proved to be severely affected by chronical tuberculosis. The fibrocaseous substance occupied almost the whole gland, lymph tissue remaining only in one corner. This lymph tissue, especially within the lymph sinus, contained small accumulations of bacilli which resembled plague bacilli. In the fibrocaseous substance no plague bacilli were found.

As all these authors gave no further details about the coexistence of tuberculosis and plague in the same organism, it seemed worth studying this question methodically in animals.

For the experiments fully grown-up guinea pigs, average weight 500 grms., were exclusively employed, as these animals are highly susceptible to plague and tuberculosis as well.

Cultures employed were : (1) a highly virulent plague culture and (2) a tubercular culture of the human type. Subcultures of the last were made exclusively on glycerine bouillon, on which medium the Tb-stock grew very abundantly. Only guinea pig Nos. 1 and 2 were infected by a sputum containing numerous tb-bacilli.

In order to show the changes in the different organs, diverse methods of inoculation for tuberculosis as well as for plague were used.

The accompanying table shows the further details about the animals employed. It appears from Table I, that the duration of the plague sickness is often somewhat shortened in the tuberculous animals, but that is not always the case (see, for instance, the relatively long duration of the disease in guinea pigs Nos. 7, 8, and 12).

It has to be mentioned that one infection with plague failed, the plague material being inoculated into the tuberculous ulcer of the skin on the abdomen (guinea pig No. 1) immediately after removing the scab. Whether in this case the bactericidal granulation tissue or the saprophytic flora of this area prevented the plague germs from penetrating into the tissue has to be left undecided (compare the following description of the tuberculous ulcer !).

Pieces of different organs were embedded in paraffin and sections, partly serial ones, were made in the usual manner. The specimens were stained by Koch-Ehrlich's method for staining tuberculous bacilli and counterstained with Löffler's methylenblue; further, Kossel-Romanowsky's method for staining plague bacilli and the hematoxylin-eosin method were employed.

The inspection of different sections showed that changes caused by both kinds of bacteria often failed to be localized in the same organs.

Therefore. out of the rather numerous sections, only those may be described here which show tuberculous as well as plague changes, giving a correct idea of the relations of both microörganisms to each other. As typical examples the following may be described :

1. Tuberculous Ulcer.

1. *Tuberculous ulcer* in the skin of the abdomen (guinea pig No. 2) the surrounding of which had been inoculated with plague bacilli by rubbing them into the shaved skin.

The sections were made vertically to the surface of the skin and to the center of the floor of the ulcer. They show a large ulcer, about 1-1½ mm. deep, 4 mm. in diameter, the precipitous walls of which are partly undermined.

The floor of the ulcer is formed by a granulation tissue containing epitheloid cells and giant-cell systems, showing on different spots small cheesy necroses. One typical small tubercle is situated in each marginal corner of the ulcer, the cheesy necroses of which reach the surface of the ulcer. A moderate number of bacilli tuberculosis is to be seen in it.

The one undermined wall of the ulcer shows for some extent a normal epithelial layer. Further on this is missing and in the necrotic corium a deep baglike cavity filled with numerous pus cells and plague bacilli is to be seen. From here a compact infiltration of plague bacilli and pus cells extends obliquely down toward the wall of the ulcer, the free surface of which is reached closely above the formerly mentioned tubercle on the marginal corner of the ulcer. The surface of the ulcer is covered here by a thick layer of pus, wherein numerous well-preserved plague bacilli are to be found. Where this pus covers the tuberculous caseation, one single tubercle bacillus without any sign of degeneration was to be found.

Toward the center of the ulcer the layer of the plague bacilli containing pus gets much smaller; there the plague bacilli have the tendency to penetrate in small groups into the granulation tissue of the floor of the ulcer lying here and there in the immediate neighborhood of well-preserved tubercle bacilli. Bacillus pestis, however, cannot be found anywhere in the deeper layers of the granulation tissue.

The walls of the ulcer have a somewhat different feature. As already mentioned, one side of the border is covered to a short extent by a normal epithelium layer which is interrupted then by a necrotic area. Farther on, the epithelium layer is intact again. Then it gets thinner, peels off, is badly stained, and is interspaced with clusters of pus cells and plague bacilli. At last, there is none of it left, while the necrotic corium is infiltrated by masses of plague bacilli and innumerable pus cells. From here broad stripes formed by enlarged lymphatic vessels stuffed with plague bacilli and pus cells take their course to the larger lymphatic vessels of the subcutaneous adipose tissue. These vessels,

too, are considerably enlarged, and here and there literally obstructed by plague bacilli and pus cells.

On the other side of the ulcer the histological changes of the wall are somewhat different. Here the epithelial layer is lacking only in one small spot immediately before the wall inclines to the floor of the ulcer. Everywhere else it is quite well preserved except slight exfoliation, due to the loss of its horny part.

In the lymphatic clefts of the papillæ single groups of plague bacilli are to be found. At one place, a larger cluster of plague bacilli lies immediately under the basal layer of the epidermis. This part of the border, which is deprived of epithelium, is formed by granulation tissue containing a small caseated area where few tubercle bacilli were found. The precipitous wall is only near the floor of the ulcer covered by a thin layer of pus. This pus contained a small number of faintly stained plague bacilli. In the granulation tissue of the already-mentioned tubercle situated in the marginal corner, numerous smaller or larger clusters of plague bacilli are to be seen. Besides it, smaller groups of plague bacilli occur here extending themselves in the lymphatic clefts which pass to the larger lymphatic vessels, situated in the deeper parts of the subcutaneous tissue. Plague bacilli lying often here closely to tubercle bacilli show morphologically no signs of degeneration. The Tb-bacilli are likewise well preserved. In the area of caseous degeneration itself plague bacilli are not to be seen; they were found only in the granulation tissue. The lymph vessels here are likewise enlarged and stuffed with plague bacilli and pus cells, as well as the larger lymphatic network passing to the subcutaneous tissue. This network may be pursued here a long way under the intact skin. At one place the lymph vessels entirely filled with plague bacilli are surrounded by a larger accumulation of tuberculous granulation tissue which contains a small tubercle, the center of which is caseated, and several quite minute necrotic areas. Plague bacilli are scarce here and lie only in the neighborhood of the lymphatic vessels.

Although in this guinea pig bacteriæmia was proved bacteriologically, in this specimen plague bacilli could not be noted in the blood vessels.

2. INGUINAL LYMPHATIC GLANDS.

The histological feature of a lymph gland, infected simultaneously by plague and tuberculosis, depends on the tuberculous changes of the tissue, namely, whether the diffusely caseating or the miliary form has developed.

A Diffusely Caseating Tuberculosis of Lymphatic Gland and Following Plague Infection. This form is well represented by a lymphatic gland of guinea pig No. 2. (Tb. subcut. inf.; Bac. pestis: cutan. inf.)

The very enlarged inguinal gland is almost entirely occupied by a tuberculous focus sharply demarcated from its surroundings by a capsule of connective tissue. Within the latter follows a small layer of epitheloid tissue containing giant-cell systems and numerous well-preserved tuberculous bacilli. Toward the center it merges into a broad zone of beginning necrosis containing numerous tuberculous bacilli, plenty of leucocytes showing nuclear degeneration (Karyorrhexis karyolysis and hyperchromatosis); still farther to the center there is to be found only caseation without any structure.

On the two opposite poles of the tubercular focus the remnants of nonaffected glandular tissue are to be seen. Everywhere else the tubercular tissue reaches up to the capsule. The blood vessels and capillaries of this region are very enlarged and tightly filled up with blood, containing plague bacilli in small numbers. Here and there small hæmorrhages are observed. The structure of the lymphadenoid substance is hardly to be recognized, being homogeneously infiltrated by numerous lymphocytes, less numerous polynuclear leucocytes, and many plague bacilli. The latter are often situated intracellularly and well preserved.

In many parts of the tissue the nuclei of the cells are already faintly stained, in other parts cortical nodules without a germ center and rarely containing some plague bacilli may be recognized, though with difficulty.

Where the sinuses can be distinguished, they are enlarged and contain, besides swarms of plague bacilli, big pale cells with granulated protoplasm and faintly stained nuclei, polynuclear leucocytes which have almost completely lost the electron for dyes, numerous lymphocytes, and occasionally single red blood corpuscles. The plague bacilli lie very densely in and near the cortical sinuses, and considerably decrease in number in the direction of the tuberculous focus. Here and there the tissue near its capsule is almost free from plague bacilli.

In the capsule of the tubercular focus itself only a few plague bacilli in single small groups may be seen outside the blood capillaries. These wisps partly penetrate into the epithelial tissue situated under the capsule. Occasionally plague and tubercle bacilli lie side by side, none of them showing any kind of degeneration.

In the zone of the commencing caseation, however, plague bacilli are already entirely absent.

B. Miliary Form of Tuberculosis and Plague Infection in the Same Lymphatic Gland. The sections were made from the primary plague bubo (inguinal lymph gland of guinea pig No. 3 (Tb. infection subcut. B. pestis cutaneous inf.).

The original structure of the lymphatic gland could not be recognized any more. In sections there are to be found large, pale areas mostly of round or oval shape. Theye are separated from each other by bands of somewhat darker staining tissue, but often they communicate with each other without such a boundary.

These somewhat darker staining stripes consist of sparse remainders of lymphoid tissue, partly of a necrotic tissue densely infiltrated with broken-down nuclei and nuclear débris. On some spots hyalin is to be found there in the form of a more or less coarse network extended between the nuclear débris. Bacteria in these areas are sometimes not to be found, but mostly numerous plague bacilli showing often degenerative changes were noted. The remains of the lymphadenoid substance are densely infiltrated by lymphocytes.

Now and then remains of a trabecle are to be seen which contain small blood vessels with often hyalin-degenerated walls. Occasionally blood vessels literally blocked with plague bacilli occur, or sinuses filled up with polynuclear leucocytes and plague bacilli are still recognizable. Plague bacilli, frequently arranged in rosary-like clumps, are often situated in these darkly stained bands. They are often encircled by a zone of karyorrhectic polynuclear leucocytes and nuclear débris projecting across the already-mentioned pale tissue. This tissue consists mainly of epitheloid cells, numerous giant-cell systems, and scattered plague bacilli. In these regions small necrotic foci are to be found abundantly showing nuclear débris and often a coarse network of hyalin. Bacilli are sometimes absent. But mostly the presence of numerous tubercle bacilli, in other cases of heaps of plague bacilli, betray the real character of the necrosis.

Further, there are extensively caseated patches bordering on large plague foci that contain numerous polynuclear leucocytes. In these areas occasionally well-preserved plague and tubercle bacilli are to be seen lying closely side by side.

But nowhere do plague bacilli occur in the caseated tissue itself. In the sections the plague bacilli mostly are stained satisfactorily showing ovoid form and bipolar staining. Only here and there pale stained or round-shaped forms are noted.

3. TUBERCULAR NODES IN THE OMENTUM.

Guinea pig No. 7, peritoneal Tb-inoculation, 23 days later cutaneous plague inoculation.

The nodes consist of an accumulation of larger and smaller tubercles, respectively, conglomerate tubercles with extensive necrosis in their centers. Tubercle bacilli are fairly numerous and partly scattered in the tissue, partly conglomerated to large clumps. Besides the ordinary long and narrow rods shorter and thicker individuals as well as granular forms are met with.

The blood vessels in the neighborhood of the tubercular nodules contain very numerous plague bacilli. At many spots larger or smaller hæmorrhages into the tubercular nodules have taken place.

These fresh hæmorrhages are situated partly in the periphery of the nodules, partly in the center, where they literally caused ruptures

of the caseous substance. Groups of plague bacilli are to be seen in these hæmorrhages, while bigger clumps of them are not noted.

In the immediate neighborhood of these hæmorrhages small groups of plague bacilli are seen penetrating a short distance into the tubercular nodule, being situated in these places quite near to tubercle bacilli. But at a short distance from the hæmorrhages they are absent.

In the smaller entirely epithelial tubercular nodules hæmorrhages are absent and owing to this fact the plague bacilli are to be seen only in the peripheric capillaries and eventually also in their walls, but are never situated in the tissue itself.

4. The Spleen.

The feature of the spleen seems to depend upon the method of inoculating the Tb-bacilli and upon the interval between the two infections.

A. Changes in the spleen caused by tubercular and soon (11 days afterwards) *following plague septicœmia* (guinea pig No. 5 infected by heart injections).

The spleen *in toto* is densely filled with numerous small, roundish foci of different sizes. The smallest ones, lying in the pulp, consist only of a few faintly stained pulp cells and polynuclear leucocytes; in and between them small groups of plague bacilli are to be found, and often isolated Tb-bacilli are associated with them.

In the pulp itself polynuclear leucocytes, erythrocytes, and hemosiderin cells may be distinguished, the nuclei of which have frequently lost already their electron for stains. Plague bacilli are abundant in the pulp. They are well preserved and often situated intracellularly.

The sinuses are enormously enlarged. In their lumen red and white blood corpuscles, numerous well-preserved and stained plague bacilli and often also a network of a filiform coagulated substance is to be seen. In numerous places, mostly roundish foci of different sizes are projecting into these sinuses; their matrix is a network adopting intensively Eosin stain. In the meshes of it, faintly stained nuclei, cellular débris, and plague cells, partly scattered, partly situated in clusters, are met with. Often, also, some tubercle bacilli are detected within.

Beginning with these small necroses foci of all sizes up to the large nodules are met with. The latter are also frequently situated around the enlarged sinuses or like grapes in a bunch arranged round about the trabeculæ. The nodules themselves have the size of a Malpighian corpuscle but coalesce sometimes to larger foci.

These nodes consist of a partly granulated, partly fibrillar ground substance that stains well with Eosin and contains zoögloeal masses of bacilli, abundant nuclear débris, broken-down leucocytes, and occasionally blood pigment.

In the smaller nodules clumps of plague bacilli are found in the center; in the larger ones they generally lay in circular form in the periphery or are irregularly distributed over the whole focus. The plague bacilli mostly stain well and are of normal shape; bipolar staining is frequent. Globular forms having lost their electron for stains occur rarely.

On the circumference of the nodules the structure of the necrotic pulp being involved in the formation of the focus can still be seen.

Very many of these foci show scattered tubercle bacilli, some in the peripheral portion, some directly between the heaps of plague bacilli. Occasionally, well-preserved tubercle bacilli are observed even in an indenture of a bacillar clump.

Besides many giant cells of the Langhans' type, containing frequently one or several tubercle bacilli, are found in the circumference of the nodules or round about them. Never plague bacilli are inclosed in these giant-cell systems,* although ingested bacilli are common and often detected in the pulp within giant cells with one lobulated nucleus (megakaryocytic type).

The Malpighian corpuscles are greatly diminished in number, the lymphoid tissue of them being increased, plague bacilli are rarely seen in them. Occasionally they are partly substituted by an epithelial tissue where here and there tubercle bacilli are found.

B. Changes in the spleen, where subculaneous tubercular infection was followed after a long interval (30 days) *by cutaneous plague infection* (guinea pig No. 2).

Tubercles were present in great numbers throughout the whole organ. Apparently they often spring off from the Malpighian corpuscles, as remnants of their lymphoid tissue are frequently found on the periphery of the tubercles. These are mostly larger than the follicles, showing caseation in their centers. Here and there larger foci are formed by confluence. Giant-cell systems and tubercle bacilli are observed but in small number, while no plague bacilli can be detected within.

Besides these tubercles, plague necroses were present in enormous numbers. They are likewise round-shaped but much smaller, reaching at best the size of a Malpighian corpuscle. By confluence, sometimes larger, irregularly shaped foci are formed. The smallest of these necroses involve a few almost broken-down pulp cells, some fragmented polynuclear leucocytes and dense clusters of bacilli, lying in the center. The larger ones of these foci are composed of similar elements : A granular substance includes abundant nuclear débris, fragmentated cells, and thick well-stained clumps of plague bacilli. Occasionally, several

---

* Giant cells of Langhans' type have been observed already in spontaneous and chronic experimental rat plague. Only one case refers to an acute state of experimental rat plague. Ledingham, to whom we owe a detailed study of them, mentions nothing about phagocytosis of plague bacilli by this category of cells.

of these foci are bordering on a tubercular nodule, but no plague bacilli are immigrating into it.

As to the pulp itself, the number of pulp cells is much increased and the sinuses are very enlarged and extremely congested with blood. The lymphoid tissue is remarkably reduced : here and there only sparse remnants are to be found. In the pulp substance plague bacilli are very rare, except within the necroses.

5. The Liver.

From guinea pig No. 5. Tb-and plague infection by heart injection Interval between both inoculations : 11 days.

The liver shows marked hyperæmia of its blood vessels and capillaries, as well as fatty degeneration of its cells. The capillaries contain very numerous well-preserved plague bacilli. The latter are frequently included in polynuclear leucocytes; especially often they are situated in great numbers inside the Kupffer's stellate cells.

The interlobular tissue is often enlarged by a granulation tissue in which Langhans' giant-cell systems are very common, as well as individual tubercle bacilli, mostly situated intracellularly. Sometimes tubercle bacilli already penetrating into a hepatic lobule are noted. They are then included into a small group of liver cells bordering on the interlobular connective tissue. The nuclei of those cells are mostly vesicular, staining faintly, if ever.

The hepatic lobules, besides those small foci, show also numerous larger ones. These are roundish, sometimes also oblong or quite irregularly shaped. They are mostly situated near the interlobular connective tissue or border immediately on it.

They are very different in size. Commonly they reach the central vein of the hepatic lobule. But also foci extending over one or even several lobules may be observed. Those areas exhibit an elective attraction for Eosin stain and consist of homogeneous columns showing yet distinctly the former arrangement of the liver cells. Only in the center of the largest of these foci is to be found a crumbly substance inclosing a large amount of nuclear débris. On the margins of these foci the nuclei still take the stain, although faintly. Farther on to the center they have lost their electron for stain at all.

Inside of these foci numerous tubercle bacilli are to be found. Besides they are often detected in the liver cells of the neighboring areas which are not affected as yet. Plague bacilli are absent in these necrotic foci. Not rarely, small plague necroses, immediately bordering on these larger tubercular foci, are to be seen. In these cases occasionally plague and tubercle bacilli lie closely side by side.

Corresponding to the tubercular foci these plague necroses are situated near the interlobular tissue, but mostly round-shaped, seldom extending to the central vein of a hepatic lobule. The smallest of these plague necroses consist of a wisp of plague bacilli, having apparently its origin in a capillary or broken-down Kupffer's stellate call. Around it several fragmented polynuclear leucocytes and very few broken down liver cells are to be seen. Sometimes those foci immediately border on one of the already mentioned smallest tubercular necroses.

Larger plague foci have a crumbly ground substance, changing at the margins into homogeneous columns stained intensively with Eosin. These columns still show the original structure of the liver, and here and there also faintly stained nuclei are to be seen. Throughout the whole focus there are distributed polynuclear leucocytes as well as plenty of nuclear detritus and degenerated nuclei.

Dense clusters of plague bacilli intensively stained are situated in the central parts of the focus. Besides tubercle bacilli are likewise observed in these nodules. They are often situated in the region of the homogeneous columns, but sometimes, also, in the center between the clumps of plague bacilli. They are well preserved, without any signs of degeneration.

The bile ducts and their walls are free from tubercular and plague changes. In their lumen, plague or tubercle bacilli were never detected.

The mutual relationship of the two bacilli *in the lungs* could not be studied in the guinea pigs used in these experiments.

The great difficulties in producing primary pneumonic plague in guinea pigs are well known. It is also rather difficult to produce primary tuberculosis in the lungs of guinea pigs by inhalation. Therefore these experiments were dropped.

Also the secondary changes, caused in this organ by both microörganisms were never concentrated in the same areas.

Thus, for instance, miliary tuberculosis was found only in the pleura, combined with small plague necroses in the lung parenchyma. Another time, miliary tuberculosis of the lungs without any plague changes was seen, etc.

It would be of interest to proceed with these kinds of experiments on animals susceptible in a high degree to tuberculosis by inhalation as to pneumonic plague

As the *kidneys* and the generative organs in guinea pigs never get affected by tuberculosis (Löwenstein), it could a *priori* not be expected to demonstrate the coincidence of both microörganisms in these organs.

The results drawn of this histological material can be summarized as follows :

1. Plague bacilli being present in the pus on the surface of a tubercular ulcer did not immigrate deeply into the specific tubercular granulation tissue that forms the floor of the ulcer. It seems to be difficult for these bacilli to deal with this obstacle.

2. The same lymphatic vessels of the subcutaneous tissue, which have transported already tuberculous baccilli and which are surrounded by tubercular tissue, served afterwards as a medium for the proliferation and the outspread of the plague bacilli.

3. Plague bacilli penetrate the capsule of diffusely caseated tubercular glands and may be found still here and there in the epithelial tissue, where they adjoin the tubercular bacilli, but never grow into the caseated area itself.

4. The adjacent bacteria did not show any degenerative types (involution forms). It seems, therefore, evident that the mutual contact does no damage to them.

5. The plague bacillus may cause a primary plague bubo in a gland having already undergone tubercular changes.

In this case it establishes itself in those parts of the gland which are free from caseated tubercular necrosis. In the tubercular epitheloid tissue, however, the plague bacillus may be detected in small numbers.

6. When the organism of the guinea pig is infected directly by the blood stream with both bacteria, the interval between the two inoculations being only a very short one (in our case 11 days), small necroses, caused by each of the microörganisms, may be observed in the spleen pulp. These foci of different origin not only border on each other, but are even very often seen merging into each other.

7. Inclosed plague bacilli are found abundantly within the pulp cells and the giant cells of the megakaryocytic type are frequently present in the pulp. They were never detected in the Langhans' giant-cell systems, which contain, very often, ingested tubercular bacilli.

8. Hematogenous inoculation of tubercular and plague bacilli within a short interval causes two, in some respect, markedly different small necrotic foci of the liver.

a. Military tbc. foci penetrate apparently into the hepatic lobules from the interlobular tissue. They produce degeneration and necrosis of the hepatic cells, showing still distinctly at their periphery the original arrangement of the liver-cell columns. They are mostly roundish, smaller than half of one hepatic lobule, and extend themselves frequently to the central vein or form by confluence larger irregularly shaped foci.

b. The foci caused by the *plague bacilli* take their origin from the capillaries of the liver (often apparently from the Kupffers' stellate cells broken down by the masses of injested plague bacilli). They are

round, mostly smaller by far than a hepatic lobule and interspaced by great numbers of polynuclear leucocytes. Owing to their abundance of cells and bacteria, they are noticed in sections with low magnification as dark spots, while tubercular necroses are larger, homogeneous, and brighter.

9. Although these necrotic foci of different origin, situated nearly in the same regions of the liver, often border on each other and merge into each other, no damage is done to either of the bacteria.

10. The enormous clusters of tubercular bacilli in the nodules of the omentum caused by peritoneal inoculation of them may be literally torn asunder by the hæmorrhages of the subsequent plague infection. Thus heaps of both kinds of bacilli come in contact with each other.

The tubercle bacilli, being situated in the center of the bacillar clumps and passing in this way to the hæmorrhages, show here and there granular and splinter forms while no involution forms of plague bacilli are observed in these areas.

Finally, a few experiments were made in order to examine the association of the two microörganisms in vitro.

I. THE GROWTH AND VITALITY OF THE PLAGUE BACILLI IN TUBERCULOUS CULTURES.

A loopful of a highly virulent plague culture was carefully deposited upon the surface of each of some well developed 5 weeks' old tubercular cultures on glycerin bouillon. A previous examination of the originally slight acid bouillon (*natursauer*) showed distinct acidity. The Tb.-plague cultures inoculated in this way were kept in the incubator at 25°-30° C.

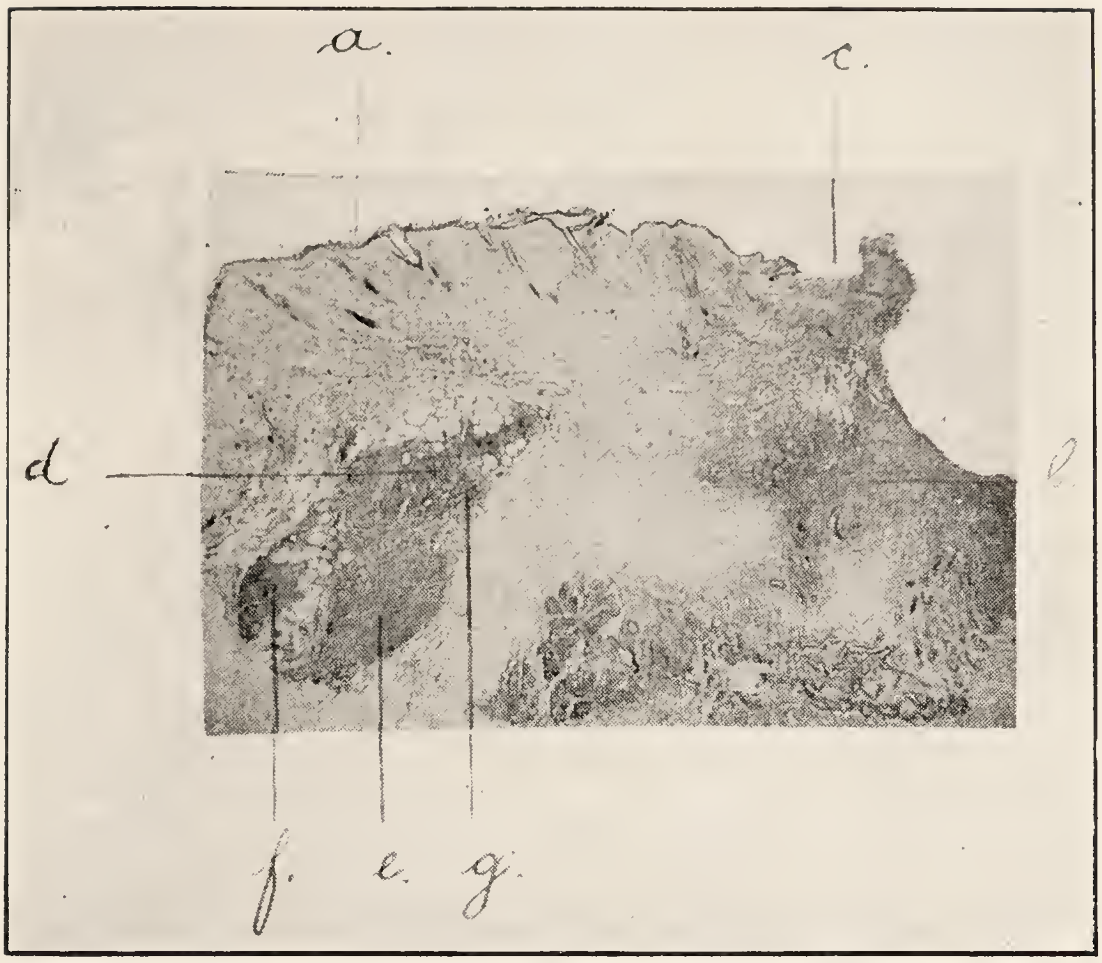
After two days the turbidity of the bouillon proved the growth of the plague bacilli.

Some days afterwards the turbidity of the bouillon partly began to clear up, while the cloudy precipitate on the bottom of the flask increased. The characteristic fragrance of fruits of the tuberculous cultures remained unchanged.

A week after the inoculation of the bouillon with plague bacilli one can observe that the surface growth of the tubercular bacilli has become creamlike. The characteristic fragrance of the Tb. culture still persists.

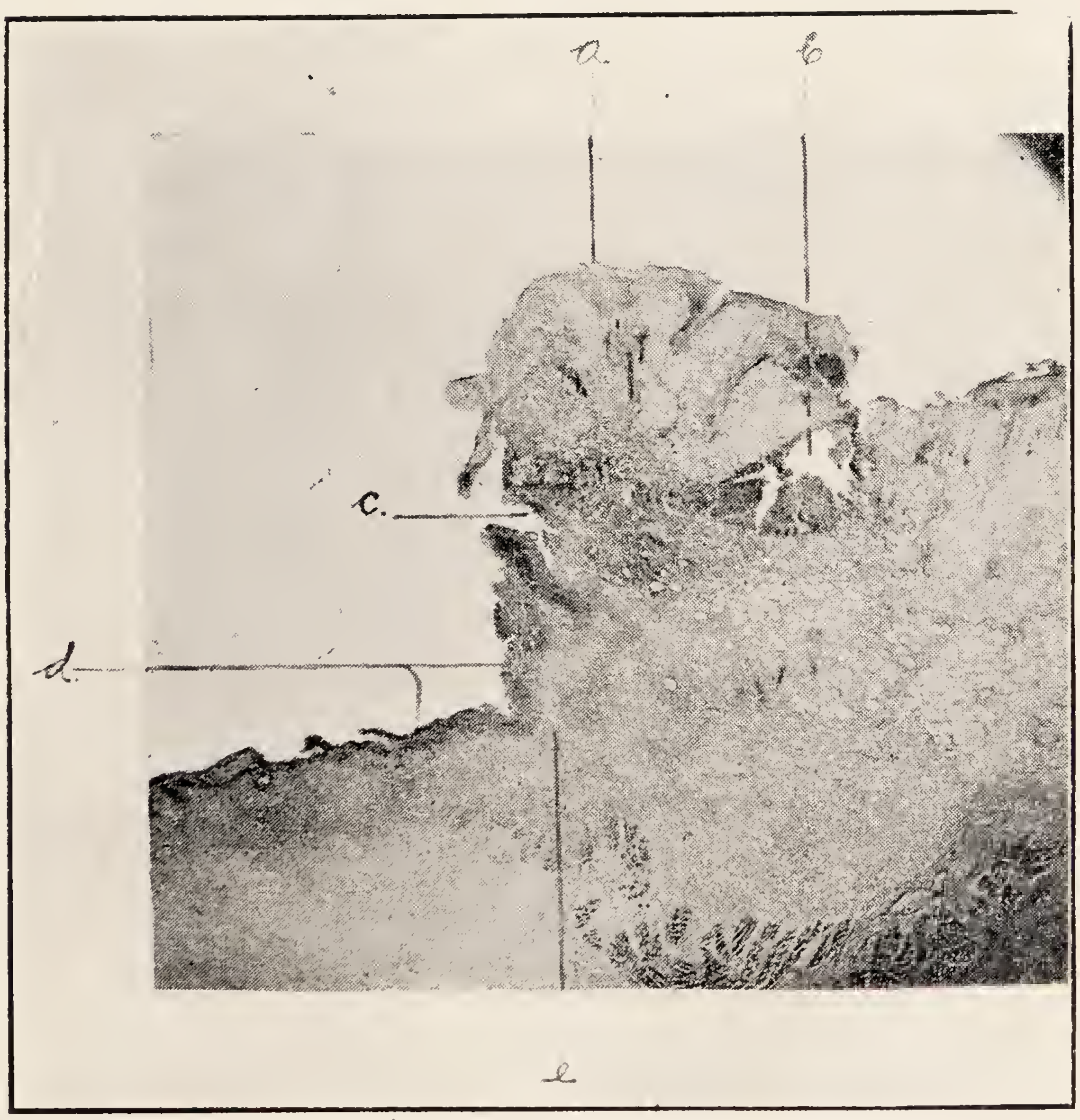
Subcultures, on agar, made from the pellicle on the surface, showed, after 48 hours, abundant growth of colonies of plague bacilli in pure culture.

1. One Side of the Tubercular Ulcer (from Guinea Pig No. 2)



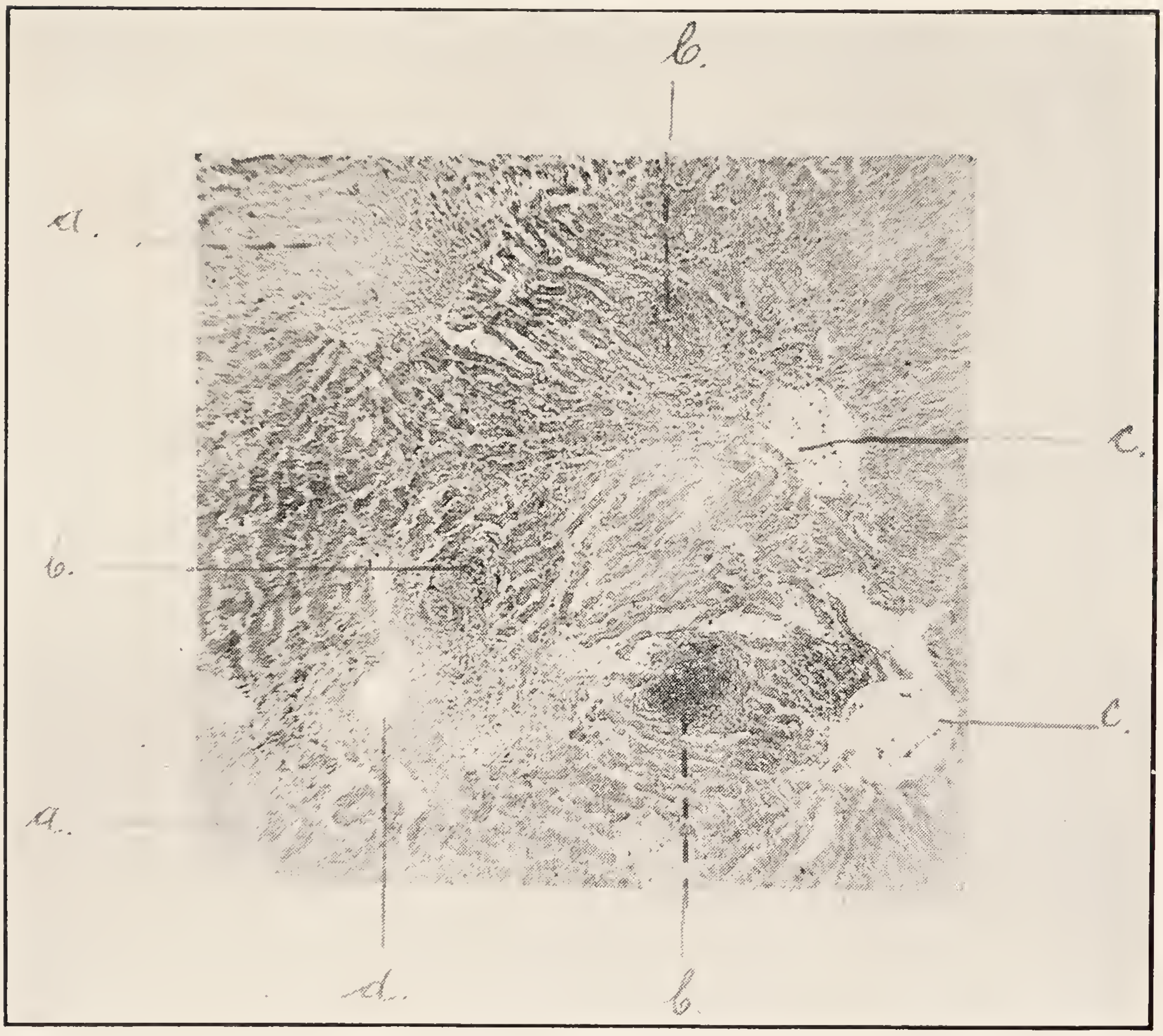
a Normal epithelial layer.
b. Tubercle in the corner of the ulcer.
c. Loss of the epithelial layer.
d. Clusters of plague bacilli.
e. Large tubercle with caseous degeneration.
f. Lymph vessel filled with plague bacilli.
g. Tubercular tissue surrounding the lymph vessels.

2. The Other Side of the Tubercular Ulcer



a. Normal epithelial layer.
b. Baglike cavity, filled with pus cells and plague bacilli.
c. Spot where the plague bacilli are breaking through into the ulcer.
d. Layer of pus containing numerous plague bacilli.
e. Tubercle, containing numerous tubercle bacilli.

3. Liver of Guinea Pig No. 5 Showing Tubercular and Plague Changes



a. Tubercles.
b. Small plague necroses.
c. Central veins.
d Interlobular vein; the perivascular tissue showing beginning tubercular changes. Numerous Tb. bacilli, and plague bacilli are to be seen there.

The mixed culture then remained untouched for six weeks in the incubator at 25° C.

Six weeks after the inoculation of the tubercular culture bouillon with plague bacilli, again subcultures were made on agar, and pure plague cultures were obtained.

Smears, made from the surface growth of the glycerin bouillon, show clusters of well-preserved tubercular bacilli and numerous plague bacilli, not taking up methylene blue stain very well and showing partly involution forms.

Fifty days after inoculation of the tubercular culture with plague bacilli four guinea pigs were infected by it.

	INFECTED WITH	MODE OF INFECTION	AFTER	DIED
Guinea pig No. 1, 540 gr.	The agar subculture made from the contaminated Tb.-glycerin broth 6 weeks after the inoculation with plague.	Cutaneously.	4 days	Typical acute bubonic plague; from the parenchymatous organs pure plague cultures obtained.
Guinea pig No. 2, 640 gr.			8 days	
Guinea pig No. 3, 540 gr.	Material from the flask containing the mixed culture "tuberculosis and plague."		7 days	,,
				,,
Guinea pig No. 4, 630 gr.	The original pure plague culture (subcultures made on agar).		5 days	,,

This table shows that the virulence of the plague bacilli had been only slightly if ever diminished, although they had been in contact with the tubercular culture in glycerin bouillon for 50 days.

Although the growth of the plague bacilli was only a scanty one, —on account of the acid reaction of the medium,—the bacilli were, notwithstanding, able to kill a guinea pig after 7 days.

It has to be emphasized here that the aërobic plague bacillus has concentrated its growth mainly on the surface of the bouillon, that is, directly in the tubercular culture. Further on, it is a remarkable feature that the plague bacillus, producing alkali (Sticker, Kolle-Hetsch, W. Goss a. o.) is counterbalancing the acid-producing tubercle bacillus, a fact that is of some influence on the reaction of the medium.

A similar "symbiosis" in nutrient medium has been stated already for pneumococcus (Frankel-Weichselbaum), and plague bacillus as well as for authrax and plague (W. Goss, *Arch biol. nauk.*, 1904).

In my own experiments the production of acid by the tubercular bacillus was always present and the mixed bouillon cultures always showed acid reaction.

II. Growth of Bac. Tuberculosis (Typus Humanus) on Glycerin Bouillon, in Which Previously Plague Bacilli Have Been Cultivated for Weeks.

Three bottles of glycerin broth (*natursauer)* were inoculated with fresh and highly virulent plague culture. Turbidity and increasing cloudy sediment in all bottles demonstrate the growth of the plague bacilli.

Ten days after inoculation from each bottle subcultures were made on agar. On all thus inoculated agar tubes after 48 hours grew typical plague colonies in abundant number.

Twenty days after inoculation the bouillon again began to clear up. On the floor of the flasks abundant sediment was to be seen.

Then each of the three flasks was inoculated with a scale of equal size from a six weeks' old rich surface growth of a human tubercular culture. At the same time three control flasks containing pure glycerin bouillon were also inoculated with tubercular bacilli in the abovementioned way. Previously, from each of the three "plague Tb. flasks" a loopful was inoculated on agar slants.

Only from one of the flasks growth of numerous plague colonies was obtained. The slants with the material of the two other bottles remained sterile (obstruction of growth by glycerin, after Albrecht and Ghon, and surplus of acidity in the nutrient medium).

Already 5 days after inoculation each of the six flasks of the tubercular material showed the same stage of incipient growth of the Tb. culture.

Ten days afterwards the growth of the pellicles had already reached the walls of one "plague Tb." and two control flasks.

Fourteen days after the Tb. inoculation the whole surface of the nutrient medium was entirely covered by the tubercular culture in two plague Tb. and the three control flasks. In the third "plague Tb. flask" the tubercular pellicle reached only partly the walls of the bottle.

At the same time, i. e., 34 days after plague and a fortnight after Tb. inoculation of the flasks, 0.2 c.c. of their sediment was injected subcutaneously into three guinea pigs, so that each of the animals was infected from another flask.

The animals survived. Apparently the plague bacilli, weakened by the strong acid reaction of the medium, were destroyed by their cultivation for weeks in the incubator at 38° C.

Agar slants, inoculated likewise by the sediment of these flasks, remained sterile.

The results of these investigations in vitro can be summarized as follows :

1. Plague bacilli inoculated into the surface growth of tubercular cultures in glycerin bouillon can exist there and preserve their virulence for months.

2. The tubercle bacillus grows abundantly in glycerin bouillon, some weeks before inoculated with plague bacilli.

Conclusions.

Plague bacilli do not penetrate into caseated tubercular tissue and are only seen in small numbers in the tubercular epitheloid tissue.

Small Tb. and plague necroses may fuse together.

Plague bacilli when mixed with tubercular bacilli do not show any involution forms.

In vitro the two kinds of bacteria do not essentially injure each other.

The photomicrographs have been taken by Dr. J. W. H. Chun. I am deeply indebted to him for this and for other ways of assistance he has rendered me.

References.

1. Reports of Austrian Plague Commission, 1898-1900.
2. Reports of German Plague Commission, 1899.
3. Müller-Poech. Die Pest., 1900.
4. Lustig & Galeotti, "Versuche mit Pestschutzimpfung bei Tieren" med, Wochenschrift, 1897, No. 15.
5. W. Goss (quoted from Astrakhan Report 1, 1907).
6. Gotschlich (quoted by Sticker.)
7. Mukden Report, Manila, 1912.
8. Fujinami & Wu, "A Study of the Morbid Histology of the 1921 Manchurian Plague Epidemic," Report, 1923/24, North Manchurian Plague Prevention Service.
9. Astrakhan Plague Report, St. Petersburg, 1907.
10. *Archiv. biolog. nauk.*, 1904, XI.
11. Löwenstein E. Vorlesungen über Tuberkulose, Jena, 1920.
12. Häser, Geschichte der Medizin, quoted by Müller-Poech.
13. J. C. G. Ledingham, "The Pathological Histology of the Spleen and Liver in Spontaneous Rat Plague," *Journ. of Hyg.*, Vol. VII, No. 3, 1907.
14. Griesinger, quoted by Müller-Poech.
15. Sticker G., "Die Pest." Giessen, 1908/10.

H. M. Jettmar, m.d. (Wien),
Serologist, P.P.S.

NOTES ON THE VITALITY OF PLAGUE BACILLI IN STAINED SMEARS.

Reprinted from the National Med. Jl. of China, Vol. XII, No. 1, 1926.

The vitality of *B. pestis* has been carefully studied by drying on splintered glass or cover slips.

Kitasato,[8] in Hongkong, smeared bubonic pus on cover slips, dried them at a temperature of 28°-30° C. and found the plague bacilli still alive after two days, but dead after four days. Wilm,[13] working also in Hongkong with pure cultures of plague bacilli, observed that smears on cover slips kept in the exsiccator at 29°-31° C. for three hours contained no living bacilli. Abel [1] stated that plague bacilli died after two hours when dried at varying temperatures on cover slips, whether they were in pure culture, in blood, pus, or smears from different organs. Gabritshevsky [4] dried blood which contained plague bacilli on slides at room temperature and found the bacilli dead after twenty-nine days. The German Plague Commission [5] maintained that after two days plague bacilli could no longer be cultivated from material dried on splintered glass.

The action of direct sunlight on a thin film of plague bacilli on glass is especially marked. Thus, bubonic pus, dried on cover slips for four hours, did not contain any living bacilli (Kitasato). The same result was obtained after four hours (Wilm), two hours (Giaxa and Gosio), and one hour (German Commission) by using pure cultures of plague bacilli. From thin films of a suspension of plague bacilli in broth, no growth could be obtained after one hour (Abel, Gladin), but thin smears of cultures on agar showed living plague bacilli after an exposure of two hours (German Commission) and even three and a half hours (Abel) to direct sunlight. As all these investigations were carried out in India at a high outdoor temperature of about 30° C., no general conclusions can be deducted from the results.

Gladin,[7] carrying out detailed studies on this subject, worked frequently at an outdoor temperature of 14°-24° C. He stated that plague bacilli in cover-slip smears of plague organs were still alive, corresponding to the thickness of the films, when kept for one to eight days at room temperature and protected from direct sunlight. The same results were obtained by keeping the smears in the incubator up to two days.

A strange observation of Sticker [11] may be mentioned here. In 1897 he brought several small boxes containing smears of plague material on cover slips from India to Germany. In 1906, he put some of these cover slips into nutrient bouillon and got cultures with the microscopical and biological features of plague bacilli. Circumstances did not permit him to use sufficient experimental animals, and thus it was not clear whether real plague bacilli were grown or not.

In a general study of the vitality of different kinds of bacteria, when dried on glass and other materials, Ficker[2,3] stated that, besides other conditions under which the drying is done, certain factors play an important rôle, viz., the medium in which the plague bacilli are dried, the rapidity of the process of drying, the drying capacity of the air, the age and virulence of the culture, as well as the temperature at which the bacilli were cultivated.

Thurn's investigations [12] showed that dried and stained smears on slides often contain living bacilli. He incubated the bacteria on agar for twenty-four hours and then smeared them on slides which were dried in the air, or in the incubator, or passed through the flame three times. All the unstained slides contained living bacteria, even the fragile vibrio choleræ was still alive after twenty-four hours. No difference was observed whether the slides were passed through the flame or dried under glass at room temperature in diffuse light.

On the action of stains, he found that an aqueous solution of methylene blue and fuchsin did not kill the bacteria after thirty seconds to five minutes, even the fragile vibrio choleræ surviving. Ziehl's carbolic fuchsin killed all kinds of bacteria investigated by him except *B. anthrax* and *B. mesentericus.* This action was due to the heating of the stain. Moeller's spore-staining method did not affect the growth of *B. anthrax* and *B. mesentericus. B. diphtheriæ* was killed by Neisser's stain, while Gram's stain killed all kinds of bacteria due to the action of Lugol's solution and aniline.

Treating for one minute in absolute alcohol has no influence on the vitality of the bacteria.

Schmidt,[10] in his efforts to confirm Thurn's results, came to similar conclusions. Thin smears of ten kinds of bacteria were dried for one hour in the air, then passed through the flame and treated either with an aqueous solution of methylene blue or fuchsin for thirty seconds. The bacteria proved to be still alive after this treatment. Even the washing water from the stained films and the filter paper used for drying them contained living bacteria. Films stained with Ziehl-Neelson's carbolic fuchsin become sterile except those prepared from *B. paratyphoid B, B. coli* and staphylococcus pyogenes aureus. All the ten kinds of bacteria were killed by Gram's stain. As *B. pestis* has never been used in these staining experiments, it was thought worth while to study the vitality of this relatively fragile bacterium against the destructive effects of staining.

TECHNIC.

The scheme was to imitate in every respect the ordinary method of smearing and staining plague bacilli on slides. An inguinal bubo from a guinea pig recently succumbing to plague was cut in two halves. The surface of the section was lightly pressed against a sterile slide, two to four times, care being taken to get thin smears. The thickness of numerous dried films prepared in this way was repeatedly determined and it was found that the thickest parts never exceeded eight microns.

Drying. The smears were allowed to dry in sterile Petri dishes at room temperature.

Fixation. As soon as the smears began to dry at the border, they were passed through the flame five or six times, until completely dry. Then the slide was passed once more through the flame and put back into the Petri dish. As the slides were relatively thin (0.68 mm.), a considerable heating may have taken place.

For alcohol fixation, denatured alcohol (95 per cent.) was poured on the slides and allowed to remain for thirty seconds, one or three minutes, as the case may be, and poured off. The slides were then dried by slight heating

Staining. Only stains commonly used in routine work, such as Loeffler's concentrated methylene blue and Ziehl-Neelson carbol fuchsin in an aqueous solution of 1 in 10, were employed. These more active and concentrated stains were chosen, as, according to Thurn and Schmidt, aqueous solution of aniline dyes have only a slight influence on the vitality of bacteria. Loeffler's methylene blue, representing an incomplete solution (*Schwebefaellung*, of Unna), has a very active staining power and dyes the plague bacilli after even a few seconds. The carbol fuchsin is likewise frequently used in plague work, because it always stains very well and quickly, showing very satisfactorily the characteristic bipolar staining. Gram's method was not used at all, as, according to Thurn, even *B. anthrax* is killed by this stain. The preparations were purposely over-stained. After staining, they were washed with a sterile physiological solution of sodium chloride.

Experiment. The vitality of the plague bacilli was exclusively tested on twenty-eight young but full-grown guinea pigs of an average weight of 400-600 grm.

A little sterile normal saline was poured on the slide, placed in a Petri dish, and the film was scraped off with the edge of another slide. Half of the resulting emulsion was injected subcutaneously into a guinea pig and the other half was soaked up in a swab and rubbed into the shaved abdominal skin of another guinea pig. Some of the results (guinea pig Nos. 1-16) may be summarized in tabulated form, as follows :

GUINEA PIG NO.	WEIGHT	SEX	MODE OF INFECTION		DAY OF INF.	DIED	AFTER	P. M.
1	490 g.	m.	Inoc. with mat. from the bubo of plague-infd. guinea pig	Subcut.	24 X	30 X	5½ d.	Typ. Bub. Pl.
2	520 g.	f.	,,	Cutan.	24 X	30 X	5½ d	,,

GUINEA PIGS INOCULATED WITH THE EMULSION OF SMEARS FROM THE INGUINAL BUBO.

NO.	GUINEA PIG WT.	SEX	DRIED AT ROOM TEMPERATURE	PASSED THROUGH FLAME	FIXED BY ALCOHOL	STAINING	MODE OF INFECTION	D. OF INF.	DIED	AFTER	P. M.
3	490 g.	m.	1 hr.	—	—	—	Subc.	24 X	1 XI	7½ d.	Typ. Bub. Pl.
4	520 g.	,,	1 ,,	—	—	—	Intrac.	24 X	—	—	Rem. well
5	400 g.	,,	10 min.	—	30 sec.	—	Subc.	24 X	—	—	,, ,,
6	500 g.	,,	10 ,,	—	30 ,,	—	Intrac.	24 X	—	—	,, ,,
7	400 g.	,,	15 ,,	7 times	—	—	Subc.	24 X	30 X	6 d.	Typ. Bub. Pl.
8	420 g.	,,	15 ,,	7 ,,	—	—	Intrac.	24 X	2 XI	8½ d.	,, ,, ,,
9	610 g.	,,	20 ,,	6 ,,	—	Loeffler's Meth.	Subc.	24 X	—	—	Rem. well
10	470 g.	,,	20 ,,	6 ,,	—	,,	Intrac.	24 X	—	—	,, ,,
*11	550 g.	,,	25 ,,	7 ,,	30 sec.	,,	Subc.	24 X	—	—	——
12	500 g.	,,	25 ,,	7 ,,	30 ,,	,,	Intrac.	24 X	—	—	Rem. well
13	520 g.	,,	30 ,,	7 ,,	—	1 : 10 Car. fuchs.	Subc.	24 X	2 XI	8½ d.	Typ. Bub. Pl.
14	550 g.	,,	30 ,,	7 ,,	—	,,	Intrac.	24 X	—	—	Rem. well
15	550 g.	,,	35 ,,	7 ,,	30 sec.	,,	Subc.	24 X	30 X	5½ d.	Typ. Bub. Pl.
16	540 g.	,,	35 ,,	7 ,,	30 ,,	,,	Intrac.	24 X	—	—	Rem. well

* Succumbed to pneumonia on Nov. 2; no plague bacilli were to be found in the organs.

Guinea pigs Nos. 17 and 18 were inoculated subcutaneously by the emulsion of a smear that had been dried, then passed through the flame, afterwards treated for one minute with ethylic alcohol; and stained for one minute with Loeffler's methylene blue.

Guinea pigs Nos. 19 and 20 were inoculated with an emulsion of a smear treated like the preceding, but fixed with methylic alcohol.

Guinea pigs Nos. 21 and 22 were infected subcutaneously with an emulsion of a smear which had been dried, passed through the flame, treated for three minutes with methylic alcohol, then for thirty seconds with acetic acid (½ per cent), and stained for one minute with Loeffler's methylene blue.

Guinea pigs Nos. 23 and 24 were infected subcutaneously with the emulsion of a smear that had been dried, passed through the flame, and stained for thirty seconds with methylene blue the day before and kept for twenty-four hours at room temperature in diffuse daylight.

Guinea pigs Nos. 25 and 26 were inoculated cutaneously and subcutaneously, respectively, with an emulsion made of a filter paper. The latter was pulled to small pieces, after having dried with it a stained smear of a plague bubo. This smear had been passed through the flame and stained for fifteen seconds with methylene blue.

All the guinea pigs (Nos. 17-26) inoculated with smears stained with methylene blue did not fall ill.

Interesting results were obtained from guinea pigs Nos. 27 and 28. These were infected with the saline solution used for washing the slides Nos. 11, 12, 15, and 16. This liquid—about 20 c. c.—was collected in a sterile Petri dish. Two c. c. of this were injected subcutaneously to guinea pig No. 27 (560 gms.). A swab plunged into the wash was rubbed intensively into the shaved abdominal skin of guinea pig No. 28 (510 gms.).

Guinea pig No. 27 was found dead in the morning of the ninth day after inoculation, guinea pig No. 28 at five o'clock in the same evening. Post-mortems showed, in both cases, typical bubonic plague with unusually big bilateral inguinal buboes. One of these (from guinea pig No. 28) showed already a big purulent center.

Smears and cultures were made from heart blood, spleen, and inguinal bubo of all dead guinea pigs. With the exception of guinea pig No. 11, which died of pneumonia, typical plague bacilli in smears and cultures were obtained in every case.

SUMMARY AND CONCLUSIONS.

1. Intensive fixation by passing through the flame does not kill the bacilli in thin smears from a plague bubo (guinea pig Nos. 7, 8, 13, 15, 27, 28).

2. Short fixation by alcohol after passing through the flame does not kill the bacteria with certainty (guinea pig No. 15 !). It seems that alcohol when used on a smear without previously passing it through the flame is more effective in this respect. However, no general rules can be drawn from these experiments, as they are too few for that purpose.

3. Preparations stained with diluted Carbol fuchsin may still contain living plague bacilli even when treated previously with alcohol for a short time. It has to be supposed that a few bacilli managed somehow to escape the staining, though the slide was overstained. Vital staining is not likely to have taken place (guinea pigs Nos. 13 and 15). It is remarkable that the whole procedure has done no damage to the surviving plague bacilli, as may be concluded from the short duration of the illness and the typical findings of acute bubonic plague in guinea pig No. 15.

4. By staining with concentrated alkaline methylene blue the bacilli seemed to be killed. The negative results obtained in some guinea pigs supports this contention. It may be supposed that this stain is so active because of the incomplete solution ("*Schwebefaellung*") of its elements.

5. The wash from the stained plague smears may contain plague bacilli. It has therefore to be disinfected, as well as the filter paper that has been used for drying the stained preparations. The bacilli seemed to be somewhat less virulent (guinea pig No. 28 died after nine days, and had a bubo with a purulent center; guinea pig No. 27 after eight and a half days). As the wash was partly collected from alkaline methylene blue smears also, and showed a blue color, this stain perhaps had some effect on the virulence of the bacilli.

6. As some of the infected animals succumbed and others did not fall sick at all, it has to be supposed that only a few plague bacilli were alive in the stained smears. Even the simple drying at room temperature was sufficient to protect the cutaneously inoculated guinea pig No. 4 against infection.

In conclusion, I wish to acknowledge with thanks much valuable help and criticism from Dr. Wu Lien-teh and Dr. J. W. H. Chun in the course of my work.

REFERENCES.

1. Abel, R. *Zur Kenntnis des Pestbazillus Centralbl. f. Bakt.*, Bd. 21, 1897.

2. Ficker, M., *Ueber Lebensdauer und Absterben von Pathogenen Keimen, Zeitschrift fuer Hygiene and Infektionskh*, Bd. 29, 1899.

3. The same; *Zeitschrift fuer Hygiene and Infektionskh*, Bd 59, p. 367, 1908.

4. Gabritshevsky, G., "The Biology of the Pl. Bacillus," *Russky Archiv Pathol.*, 1897.

5. German Plague Commission Reports, in *Arbeiten aus d. k. Gesundheitsamte*, Bd. 16, 1899.

6. Giaxa et Gosio, quoted after Gladin.

7. Gladin, G. P., "The Vitality of Plague Bacilli a. s. o." (in Russian), St. Petersburg, 1898.

8. Kitasato, S., quoted after Gladin.

9. Pappenheim, A., *Grundriss der Farbchemie*, Berlin, 1901.

10. Schmidt, A., *Werden Bakterien durch die uebliche Faerbetechnik abgoetet Klin. Wochenschrift*, 4 Jg., p. 1731, 1925.

11. Sticker, G., *Abhandl. aus. d. Seuchengesch. u. Seuchenlehre*, Bd. 1, Die Pest, II Teil, pp. 53, 54, Giessen, 1910.

12. Thurn, O., *Ueber die Lebensfaehigkeit an Objekttraegern angetrockneter ungefärbter und gefaerbier Bakterien, Centralbl. f. Bakt., Orig. Bd. 74*, pp. 81-90, 1914.

13. Wilm, *Ueber die Pestepidemie in Hongkong im Jahre* 1896. *Hygienische Rundschau*, 1897.

H. M. JETTMAR, M. D. (Wien),
Serologist, P.P.S.

I. EINIGE BEMERKUNGEN ZUR EPIDEMIOLOGIE UND HISTOLOGIE DER LUNGENPEST.

Abdruck aus

"Archiv für Schiffs-und Tropen-Hygiene".

1925, Band 29, S. 650—665.

Die im Winter 1920/21 in der Nordmandschurei ausgebrochene Lungenpestepidemie wurde trotz der strengen Absperrungsmassregeln durch den Schmuggelverkehr auch nach Transbaikalien verschleppt. Dort blieb sie allerdings nur auf kleine Ausbrüche in einigen nahe der chinesischen Reichsgrenze gelegenen Kasakendörfern beschränkt. Ausserdem wurden vereinzelte Fälle an mehreren Punkten der transbaikalischen Eisenbahn beobachtet.

Diese kleinen Ausbrüche konnten von mir als damaligem Leiter der in das gefährdete Gebiet entsandten russischen Sanitätsabteilung genauer beobachtet werden und bieten in epidemiologischer Hinsicht maches Bemerkenswerte.

Es sei deshalb auf sie näher eingegangen.

I. Die Lungenpestfælle in Kailastui.

Am 25. Januar 1921 kam aus dem lungenpestverseuchten Dschalainorer Kohlenbergwerke ein bereits erkrankter Chinese in die am rechten (chinesischen) Ufer des Grenzflusses Argunj gegenüber Kailastui gelegene chinesische Siedlung. Durch ihn wurden mehrere seiner Landsleute angesteckt, welche die Seuche auf chinesischem Gebiete weiter verschleppten.

Während der Krankheit des Chinesen übernachtete bei ihm der Kasak Bakschejeff, welcher von hier im trunkenen Zustande nach Kailastui zurückkehrte. Er erkrankte bereits im russischen Dorfe am 30. Januar und starb am Morgen des 2. Februar in seiner Hütte, ohne ärztliche Hilfe in Anspruch genommen zu haben. Die Leiche lag auf dem Rücken am Boden in einer Ecke des einzigen Wohnraumes der Hütte mit dem Gesicht der Mitte des Zimmers zugekehrt. Das Lager des Kranken war reichlich mit dem charakteristischen Lungenpestsputum besudelt, auch aus Mund und Nase der Leiche rieselte blutig-schleimiges Sekret. Alle zehn in der Hütte wohnenden Personen waren von dem frei ins Zimmer hustenden Kasaken angesteckt worden und starben an Lungenpest.

Wenn man in Erwägung zieht, dass die in der Hütte einquartierten Soldaten des Tages fast niemals zu Hause waren, erscheint die Annahme am wahrscheinlichsten, dass ihre Ansteckung in der Nacht vor dem Tode des Bakschejeff erfolgt ist.

Die 30 jährige Schwester des Kasaken Bakschejeff, welche ihren kranken Bruder niemals besuchte, aber nach seinem Tode bei der Leiche angetroffen worden war, wurde mit den übrigen Familienmitgliedern zusammen in der Hütte isoliert. Sie konnte erst nach dem Tode des letzten Inwohners transferiert werden, da die damaligen Umstände ihre vorherige Separierung nicht gestatteten. Sie wurde mit Masken versehen und erhielt entsprechende Verhaltungsmassregeln; sie blieb gesund.

Diesem Ausbruche verdient ein zweiter gegenübergestellt zu werden, welcher gleichzeitig in demselben Dorfe stattfand.

Im Hause W. starb die Bäuerin, eine Verwandte des B., an Lungenpest. Das erst 6 Stunden vor ihrem Tode zur Untersuchung gelangte Sputum enthielt eine Reinkultur von Pestbazillen. Sie besuchte abends, den 1. Februar, ihren kranken Schwager, erkrankte in der Nacht auf den 4. und starb in der Nacht auf den 6. Februar.

In der Hütte, deren einziger Wohnraum enger und niedriger war, als der des Bakschejeff, wohnte während ihrer ganzen Krankheit ihr Mann, zwei kleine Kinder und ein einquartierter Soldat, welche alle gesund blieben, ohne dass sie irgendeine Vorsichtsmassregel der Kranken gegenüber in Anwendung brachten (Der pestige Charakter der Erkrankung wurde ja erst 6 Stunden vor dem Tode festgestellt.) Im Gegensatze zu Bakschejeff hustete aber diese Kranke nicht frei ins Zimmer hinein, sondern sie lag in einem Bette beim Fenster, den Kopf stets der Wand zugekehrt, welche auch ganz vom Sputum besudelt war. Das Bett war durch einen niedrigen Holzverschlag vom übrigen Teil der Hütte getrennt[1]).

Als letzter erkrankte in diesem Dorfe an Lungenpest der Soldat J., welcher im Nachbarhause des Bakschejeff einquartiert war. Er unterhielt mit dem Hause des B. zur Zeit der Krankheit des Hausherrn regen Verkehr und dürfte sich am ehesten von ihm in der Nacht auf den 2. Februar angesteckt haben. Es ist jedoch noch eine weitere Möglichkeit der Ansteckung gegeben: Während der ersten 6 Stunden der Krankheit der beiden Soldaten B. und P. war er mit ihnen zusammen, obwohl er sich von ihnen ferne hielt. Die Krankheit der beiden Soldaten begann des Morgens am 6. Februar ganz plötzlich unter Schüttelfrost und raschem Temperaturanstieg auf 40,4 resp. 40,7°. Im Laufe des Vormittags wurden sie isoliert. Die wiederholte Prüfung des Sputums ergab während der Dauer des ersten Krankheitstages ein negatives

---

(1) Dass die von den Kranken eingenommene Lage bei der Verbreitung der Lungenpest eine grosse Rolle spielt, beweist z. B. auch ein von Kitasato und seinen Mitarbeitern mitgeteilter Fall. Derselbe betrifft eine Baumwollarbeiterin, welche bereits an Pestpneumonie erkrankt, in der Weberei, in welcher sie arbeitete, niemanden mit Lungenpest, jedoch 5 Mitarbeiter durch ihren am Boden liegenden Auswurf mit Drüsenpest ansteckte. Daheim jedoch infizierte sie ihre Familienangehörigen und 3 Ærzte mit Lungenpest. Sie sass bei ihrer Arbeit einer Wand gegenüber.

Resultat[2]). Niemand von der zahlreichen Familie des Nachbarn wurde von diesen Soldaten angesteckt.

Alle diese Umstände machen die Ansteckung des Soldaten J. durch seine Kameraden unwahrscheinlich. J. erkrankte am 10. und starb in der Nacht auf den 13. Seine Inkubationsperiode beträgt also die ungewöhnliche lange Zeit von 8 resp. 5 Tagen.

II. Die Pestausbrueche in Klitschki.

In diesem etwa 80 km von Mandschuria entfernten Dorf wurde die Pest durch einen aus Mandschuria heimkehrenden Bauern G. verschleppt, welcher in dieser Stadt in einem pestinfizierten Hause übernachtete. Er erkrankte am 11. Februar abends plötzlich unter Fieber, Kopfschmerzen, Husten und heftigen rechtsseitigen Brustschmerzen. Am nächsten Tage trat Bluthusten auf. G. starb in der Nacht vom 13. auf den 14. Februar. Der pestige Charakter der Erkrankung wurde erst nach 3 Tagen durch Autopsie festgestellt. Von ihm wurden drei seiner Kinder und zwei Nachbarn, welche ihn bei Lebzeiten besuchten and bei der Totenfeier[3]) zugegen waren, angesteckt. Seine anderen drei Kinder, welche während der Krankheit ihres Vaters ebenfalls in der Hütte wohnten, ein 16 jähriger Sohn, eine 12 jährige Tochter und ein 1 jähriger Säugling, erkrankten nicht. Ebenso blieben der Feldscher, welcher G. untersuchte und Lungenentzündung feststellte, sowie mehrere Nachbarn und Verwandte, welche der Leichenfeier beiwohnten, von der Ansteckung verschont.

Von den übrigen 6 Lungenpesterkrankungen auf russischem Gebiete, welche lauter Reisende betreffen, die aus dem infizierten chinesischen Gebiet kamen, verdient nur ein Fall erwähnt zu werden. Er betrifft einen 15 jährigen Burschen, welcher aus Mandschuria kommend, in Maziewskaja die 5 tägige Quarantäne absass und auf der Weiterfahrt nach Tschita erkrankte. Er wurde in Borsja isoliert, wo er starb[4]). Der letzte Lungenpestkranke auf russischem Gebiete starb am 6 März.

---

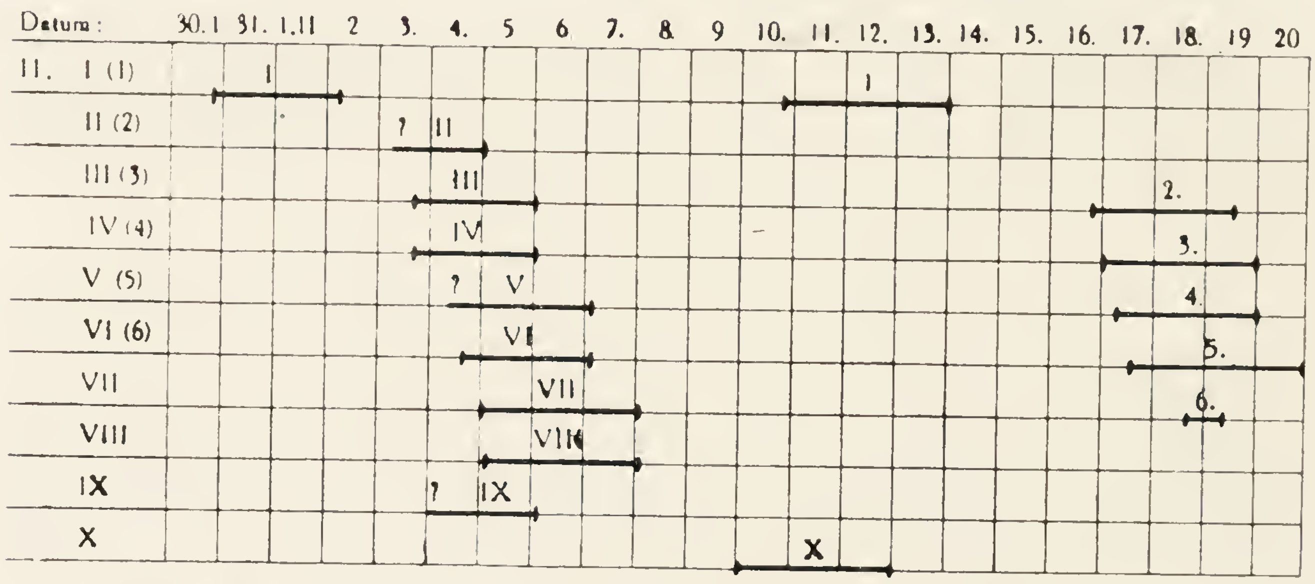
(2) Auf Grund der zahlreichen klinischen Erfahrungen, besonders von Dr. Wu und seinen Mitarbeitern, ist die Annahme berechtigt, dass der Lungenpestkranke in den ersten Krankheitsstunden infolge des noch fehlenden oder geringen bazillenhaltigen Auswurfes für seine Umgebung eine geringe Gefahr darstellt. Freilich gibt es auch Fälle, die sofort hochinfektiös sind. So hat Verfasser bei einer Laboratoriumsinfektion stark bazillenhaltiges Sputum bereits 40 Stunden nach Beginn des Fiebers beobachtet. Es handelte sich um einen Tschitaer Feldscher, den eine an Laboratoriumslungenpest erkrankte Ærztin ansteckte (2. Menschenpassage). Ein Analogon zur Krankengeschichte des Dr. Müller (Œsterr. Kom.), welcher ebenfalls am ersten Tage pesthaltiges Sputum aushustete.

(3) In Transbaikalien ist es Sitte, die Toten festlich anzukleiden und sorgfältig zu waschen. Hierauf nimmt die ganze Verwandtschaft vom Verstorbenen Abschied, indem sie ihn auf Stirn und Mund küsst. Dass diese Zeremonie auch bei gewaschenen Lungenpestleichen, bei welchen das bazillenhaltige Sekret noch lange nach dem Tode aus Mund und Nase rieselt, gefährlich ist, liegt auf der Hand. Bei der drei Tage nach dem Tode erfolgten Sektion des G. war Mund und Nase von blutigem Sekret stark besudelt.

(4) Da eine Ansteckung innerhalb der Quarantäne ausgeschlossen erscheint, betrug seine minimale Inkubationsperiode 5½ Tage. Auf Grund dieses Falles wurde in Maziewskaja die Quarantänefrist von 5 auf 7 Tage verlängert.

A.
DIE LUNGENPESTFAELLE IN KAILASTUI:
I-X.

B.
DIE LUNGENPESTFAELLE IN KLITSCHKI:
1-6.



I. Kasak B. 35 Jahre. (Chron. Pleuritis)
II. Sohn, 6 Monate
III. Sohn, 4 Jahre
IV. Sohn, 6 Jahre
V. Frau, 27 Jahre
VI. Grossmutter, 70 Jahre
VII. Einquartierter Soldat, 30 Jahre
VIII. Einquartierter Soldat, 30 Jahre
IX. Schwaegerin W., etwa 25 Jahre (lungenkrank)
X. Soldat J. vom Nachbarhaus

1. Bauer G., 51 Jahre
2. Sohn, 14 Jahre
3. Tochter, 22 Jahre
4. Sohn, 8 Jahre
5. Nachbar S., 65 Jahre
6. Nachbar P., 32 Jahre
(veruebte Selbstmord durch Erhaengen.)

Aus diesem Diagramm ist ersichtlich, dass die Krankheitsdauer im Durchschnitt 2½—3 Tage betrug. Bei jungen und bei chronisch lungenkranken Individuen (AI, AIX) war sie verkuerzt. (Die Krankheitsdauer konnte infolge Pestserummangels nicht beeinflusst werden). Der Tod erfolgte mit Ausnahme von B2 stets des Nachts oder in den fruehen Morgenstunden. Die Inkubationszeit dauerte durchschnittlich 3 Tage, wobei auffaellig war, dass die jugendlichen Mitglieder der Familie zuerst erkrankten und starben[5]. Doch konnten Inkubationszeiten mit 5 oder mehr Tagen beobachtet werden. (AX und Fall von Borsja). Die Erkrankung begann bei allen Patienten ploetzlich aus voller Gesundheit mit mehr weniger heftigem Frostgefuehl and raschem Fieberanstieg. Es gelang niemals am ersten Krankheitstage bazillenhaltiges Sputum zu bekommen. Dieses wurde zu Ende der Krankheit von allen Patienten in reichlicher Menge ausgeschieden. Bei den Kranken in Kailastui waren die Entzuendungsherde hauptsaechlich in der linken Lunge lokalisiert. (Bestaetigung durch die Autopsie bei I, II, VII und IX). Sie starben alle auf der linken Koerperseite liegend mit Ausnahme von I und X. In Klitschki hingegen war der pathologische Prozess hauptsaechlich in der rechten Lunge ausgebreitet (Autopsie bei 1 und 2, bei den uebrigen entsprechende klinische Erscheinungen.)

(5) Die Angabe einiger Autoren (Bogutsky, Budberg, Kristy, Pallon u. a.), dass die Kinder unterhalb 15 Jahren von der Pest meist verschont bleiben, konnte nicht bestätigt werden.

Acht von mir damals ausgeführte Sektionen boten nichts Abweichendes von den Befunden anderer Autoren. Es sei hier erwähnt, dass in allen—auch fast unmittelbar nach dem Tode zur Sektion and histologischen Untersuchung gelangten—Fällen die Gewebsnekrose stark vorgeschritten war. Ein grosser Prozentsatz der im Lungengewebe befindlichen Pestbazillenmassen wies bereits Involutionsformen auf. In fast jedem Falle war neben dem Pestbazillus auch ein anderes Bakterium in ziemlich reichlicher Menge in der Lunge bakteriologisch und histologisch nachweisbar. Es war ein grosses, mit Methylenblau sich intensiv färbendes langes Stäbchen mit abgekanteten Ecken, bisweilen leicht gebogen. Dieses Stäbchen windet sich in langen, oft gebogenen Zügen, die Spalten des nekrotisierten Gewebes ausnützend, durch die haufenförmigen Ansammlungen der Pestbazillen hindurch. Besonders häufig konnte es im subpleuralen Bindegewebe aufgefunden werden. In den Blutgeässen war es nicht anzutreffen. Es ist sehr wahrscheinlich, dass dieses Stäbchen mit dem von Kulescha in der Epidemie 1910/11 beschriebenen Bakterium identisch ist. Zu Lebzeiten des Kranken konnte es im Auswurf nicht nachgewiesen werden. Andere von verschiedenen Autoren erwähnte Bazillen, wie Streptopneumokokken, sowie Influenzabazillen wurden nicht aufgefunden.

Von den oben angeführten Lungenpesterkrankungen ist wohl Fall 6 aus Klitschki am bemerkenswertesten. Handelt es sich doch um einen Fall, welcher das Studium des pathologischen Prozesses am ersten Krankheitstage ermöglicht.

Der Bauer P. wurde abends, den 18. Februar, aus voller Gesundheit von starkem Frösteln befallen. Er verbrachte den ersten Teil der Nacht in seiner Hütte, klagte über Kopfschmerzen, Frostgefühl, Stechen in der Seite und kroch auf die Ofenbank. Vor dem Morgengrauen schlich er sich aus der Hütte und wurde in der Frühe am Zaune erhängt aufgefunden. Dieser Fall bot für histologische Untersuchungen optimale Bedingungen, da eine Nekrobiose auszuschliessen ist. Der Selbstmord erfolgte in einer kalten Februarnacht bei einer Temperatur von minus 25—30° C. Kopf und Hals der nur mit dem Nachtgewand bekleideten Leiche waren bei der etwa 6 Stunden nach der Tat erfolgten Inspektion bereits hart gefroren. Der Tote wurde bis zur Sektion in einem kalten Raum bei einer gleichmässigen Temperatur von etwa 0° aufbewahrt.

Leider machten es mir die damaligen Umstände unmöglich, eine vollständige Sektion auszuführen. Ich musste mich auf die Besichtigung der Lunge in situ und die Entnahme einzelner Stückchen aus verschiedenen Teilen der Lunge und Milz beschränken.

Die Inspektion ergab Hepatisation des rechten Mittellappens, von welchem einzelne Stücke im Wasser untersanken und konfluierende pneumonische Herde des rechten Oberlappens. Rechts unten schien der Prozess im Beginn zu sein, während die linke Lunge noch frei war.

Die zur Untersuchung entnommenen Gewebsstücke stammen :

1. aus dem bereits hepatisierten Lungengebiet (2 Stücke);
2. aus einem grossen Bronchus samt anliegendem Lungengewebe;
3. aus der linken Lunge;
4. aus der Milz.

Die Gewebsstücke wurden nach kurzer Formalinfixierung[6]) in Alkohol gehärtet und in Paraffin eingebettet. Als Färbungen kamen in Anwendung die Methoden nach Kossel-Romanowsky, Giemsa, Watabiki, van Gieson, die Safranin-Methylenblau-Eosinfärbung, die Hämatoxylin-Eosinfärbung, die Weigertschen Methoden der Fibrin-bzw, Elastikadarstellung.

Die aus dem hepatisierten Stücke (1) gewonnenen Schnitte bieten folgendes histologische Bild dar :

Die ziemlich stark erweiterten Alveolen sind von einem sehr zellreichen Exsudat erfüllt, das aus Erythrozyten, polymorphkernigen Leukozyten, Alveolarepithelien, Staubzellen und Bakterien besteht. Freie, noch lufthaltige Alveolen werden in diesem Stücke nicht angetroffen, ebensowenig ausgesprochene atelektatische Stellen.

Die in den Alveolen enthaltenen Erythrozyten treten bisweilen gehäuft in Form frischer Blutungen auf. An vielen Stellen kann man sie deutlich durch die geplatzte Alveolarwand hindurch in the Alveole austreten sehen, wobei sie den übrigen zelligen Inhalt vor sich herschieben und auseinanderdrängen. Oft erscheint daher eine derartige Hämorrhagie von einem dichten Bakterien-und Zellwall umgeben[7]).

An manchen Stellen findet man in den Blutungen zahlreiche runde Gebilde von etwa ⅓ Durchmesser der Erythrozyten, welche sich gleich unversehrten roten Blutkörperchen färben. Diese Gebilde, anscheinend Erythrozytentrümmer, enthalten sehr häufig einen Pestbazillus. Dieser ist in der Regel rund, mit lichtem Zentrum und liegt in der Mitte des Kügelchens. Häufig zeigt er jedoch seine normale, ovale Form mit bipolarer Färbung. In diesen Fällen sind auch die Erythrozytentrümmer entsprechend der Achse des Bazillus oval ausgezogen und umgeben ihn überall mit gleich breitem Hofe. An manchen Stellen finden wir ganz ähnliche Kügelchen, aber von rosaroter Farbe (Kossel-Romanowsky-Färbung). Diese zeigen Tendenz zur Vereinigung, wobei die Bazillen an den Rand zu liegen kommen. Anfangs legen sie sich, oft noch von einem dichten Bakterienwall umgeben, als hyaline langgestreckte, rosarot gefärbte Schollen dicht an die Alveolarwände an und in der Folge verkleben sie mit ihnen.

Die polymorphkernigen Leukozyten sind in diesem Stück bereits sehr reich im Alveoleninhalt anzutreffen. Meist sind sie nicht besonders verändert. Manchmal zeigen sie schlechte Kernfärbung, Granulierung

---

(6) Ganz kurze Formalinfixierung wirkt nach meinen Erfahrungen nicht nachteilig auf die Färbbarkeit der Pestbazillen.

(7) Es ist möglich, dass der gewaltsame Tod durch Erhängen das histologische Bild stellenweise etwas beeinflusst hat.

ihres Protoplasmas, oder man bemerkt Auffransung ihres Randes, welche so weit gehen kann, dass bisweilen die Kerne blossgelegt werden. Stellenweise sieht man Pestbazillenanhäufungen und in ihnen eingeschlossene Leukozyten. Diese zeigen bisweilen den von mehreren Autoren bereits beschriebenen, schmalen, bazillenfreien Hof. In der überwiegenden Mehrzahl der Fälle jedoch sind die Bazillen fest an den Plasmarand der gut erhaltenen Zellen gepresst. Selten sieht man innerhalb einer derartigen Bazillenanhäufung den Kern der Leukozyten in kleine, noch gut färbbare Stücke zerfallen, eine Erscheinung, welche Albrecht und Ghon, Strong, Hassan Hamdi, Signorelli u. a. sehr häufig angetroffen haben. An anderen Stellen ist nur mehr der blosse Kontur der Zelle und ein oder das andere Kernfragment undeutlich wahrnehmbar, während das ganze, früher von Leukozyten eingenommene Gebiet von einem Haufen Pestbazillen besetzt ist. Deutliche Phagozytose der Pestbazillen durch die Leukozyten wurde trotz eingehendster Untersuchung nirgends wahrgenommen.

Das Alveolarepithel ist vielfach in Ablösung begriffen. Die Zellen sind meist schön erhalten, haben einen gut gefärbten Kern und kommen an Zahl den polynukleären Leukozyten des Exsudates ungefähr gleich. Auffallend ist das Verhalten der Staubzellen, welche im Alveolarinhalt sehr häufig angetroffen werden. Sie sind die einzigen Zellen, welche deutliche Phagozytose der Pestbazillen zeigen und in grosser Menger der Nekrose anheimfallen. Es wird darauf bei der Beschreibung der Phagozytose der Pestbazillen noch näher eingegangen werden. Hier sei nur bemerkt, dass diese Zellen in den Alveolen des ganzen Lungenstückes ziemlich gleichmässig verteilt sind und in ihrem Inneren neben Bakterien nur Fremdkörper, wie Kohlepartikelchen u. dgl., enthalten, aber niemals Zelltrümmer von Erythrozyten, weissen Blutkörperchen oder anderen Zellen des Organismus.

Die in den Alveolen vorhandenen Pestbazillen sind über das ganze Lungenstück ziemlich gleichmässig verteilt. Sie winden sich oft in Form von Zügen und Ketten zwischen den zahlreichen Exsudatzellen hindurch. Die von allen Autoren betonte Anhäufung der Bazillen in den Alveolen um die kleinen Lungenvenen herum, ist auch in diesem Stück deutlich wahrnehmbar. Ihre Konzentration um die Bronchiolen ist viel weniger auffallend. Bazillenanhäufungen sind auch in denjenigen Alveolen zu sehen, welche von den Gefässen durch dicke Bindegewebszüge ziemlich weit getrennt sind. Sie nehmen stets das dem Gefäss zugekehrte Alveolargebiet ein, wobei sie einzelne, meist ungeschädigte Leukozyten fest in sich einschliessen. Vielfach enthalten sie hyalinartige, runde Schollen, welche sich oft gegen den Rand hin zu mehr oder weniger breiten, bazillenfreien Streifen verdichten. Bei gelungener Kossel-Romanowsky-Färbung weisen sie eine intensiv rosarote Tingierung auf. In denjenigen Stellen der Lunge, welche eine stärkere Kohlenpigmentansammlung zeigen, haben wir in Widerspruch mit manchen Literaturangaben nie derartige Anhäufungen von Pestbazillen in den umliegenden Alveolen ermittelt. Die in den späteren Stadien der Krankheit

häufig anzutreffende, vollkommene Ausfüllung ganzer Alveolengruppen mit Pestbazillen, deren Massen dank der Poren der Alveolarwand miteinander in Verbindung stehen (Kulescha), wurde hier nirgends wahrgenommen. Die Färbbarkeit der Bazillen in den Alveolen ist in der Regel gut erhalten. Sie ist namentlich intensiv in den Gebieten der Pestbazillenanhäufungen und lediglich dort etwas herabgesetzt, wo die Bazillen in die Zelltrümmer eingewandert sind.

Die in den Alveolen gelegenen Bazillen haben stets Kokkobazillenform. Involutionsformen sind an den extrazellulär gelegenen Bazillen nirgends zu sehen.

Häufig wird in diesem Stück Phagozytose der Pestbazillen durch Staubzellen angetroffen. Nur diese Art von Zellen enthielt Bazillen in ihrem Plasma. Anthrakosefreie Endothelzellen wiesen niemals sichere Phagozytose auf. Auf die Fähigkeit der Staubzellen, Bazillen in späteren Stadien der Lungenpest zu phagozytieren, wurde bereits des öfteren hingewiesen (Strong, Wu und Woodhead, Petin, Fujinami und Wu, Hassan Hamdi, Tsurumi und seine Mitarbeiter u. a.). Die überwiegende Mehrzahl der Autoren ist darin einig, dass die Phagozytose der Pestbazillen in der pneumonischen Lunge eine verhältnismässig seltene Erscheinung ist. In diesem aus dem Frühstadium der Krankheit stammenden Stück war Phagozytose der Pestbazillen ziemlich häufig anzutreffen. Ein genaues Durchmustern zahlreicher Präparate bot Gelegenheit, einige Beobachtungen über den Phagozytoseprozess anzustellen. Der Vorgang lässt sich etwa folgendermassen charakterisieren :

Eine Gruppe von Pestbazillen ist eng an eine Staubzelle angedrängt. Der blasse Kern ist der Bazillenansammlung oft deutlich zugekehrt. Das Protoplasma der Zelle scheint sich gleichsam über eine eng zusammengepresste Bazillengruppe oder seltener über einzelne Bazillen zu stülpen. Ist dies geschehen, dann erscheint die Bazillengruppe innerhalb der Zelle umgeben von einem hellen Hof (Vakuole). Die einzelnen Bakterien drängen sich dabei aneinander und nehmen Kugelform an. Derartige Vakuolen imponieren im Schnitt als lichte Scheiben, welche in ihrem Inneren eine kleinere oder grössere Menge eingeschlossener Bazillen enthalten. In einer Zelle können derartige Bildungen einzeln oder in grösserer Anzahl vorhanden sein. Es werden nicht selten Zellen angetroffen, deren Peripherie vollkommen von diesen Scheiben besetzt ist, während die in der Zelle stets vorhandenen Kohlepartikelchen gegen die Mitte zu abgeschoben sind. Ist die Zahl der in einer solchen Gruppe vereinigten Bazillen gross, so sind sie oft zu einem Konglomerat zusammengepresst. Bisweilen sind dabei die Bazillen in ihrer Grösse stark reduziert. Bei kleineren Gruppen sind die Einzelindividuen oft so stark agglutiniert, dass sie in ihrer Gesamtheit für Kerntrümmer gehalten werden können. In anderen Fällen dagegen scheinen die Bazillen aufgequollen zu sein. UEberhaupt ist der bedeutende Grössen- und Formunterschied für die phagozytierten Pestbazillen recht charakteristisch.

Das weitere Schicksal der Zellen scheint nun verschieden zu sein. Es gibt Zellen, welche eine grosse Bazillengruppe einschliessen, deren Einzelindividuen die normale Kokkobazillenform und bipolare Färbung aufweisen. Das Protoplasma der Zellen, welches die Bazillen halbmondförmig umhüllt, ist an einer Stelle abgeblasst, gleichsam unterbrochen, und man sieht die Bazillen durch diese Öffnung gewissermassen ausschwärmen. Der Kern der Zelle ist bisweilen pyknotisch. Andere Zellen zeigen noch die charakteristischen Vakuolen, doch enthalten diese nur vereinzelte schwarzblaue Punkte, welche mit Bakterien keine Ähnlichkeit mehr haben. Die Zelle selbst ist schwer geschädigt. Der Schatten eines Kernes ist kaum mehr wahrnehmbar, das Protoplasma zeigt scholligen Zerfall.

Von nicht geformten Exsudatelementen werden angetroffen: Fibrin, Hyalin und seröse Flüssigkeit.

Fibrin ist den Alveolarwänden stellenweise ziemlich reichlich angelagert. Man sieht dann oft die buckelförmig ins Alveolarlumen vorspringenden Kapillaren von einem halbmondförmigen Netz feiner Fibrinfäden umgeben. Im allgemeinen ist das Fibrin sehr unregelmässig verteilt. In vielen Alveolen fehlt es völlig, in anderen ist es nur in Form feiner Netze an einigen Stellen der Alveolarwand zu finden.

Hyalin ist in den Alveolen dieses Stückes nur selten anzutreffen und färbt sich nach Kossel-Romanowsky intensiv rosarot. Abgesehen von der hyalinen Entartung einiger Exsudatzellen trifft man es, wie bereits früher erwähnt, in Form von Kugeln verschiedener Grösse und Balken. Diese liegen in der Nähe der Alveolarwände, ohne dass sie mit ihnen verkleben. Oft ist das Hyalin von dichten Pestbazillenmassen umgeben, enthält aber solche niemals in seinem Inneren. Das Hyalin findet sich auch entsprechend den Pestbazillenanhäufungen um die Gefässe fast ausschliesslich in deren Umgebung. Oft liess sich Fibrin von Hyalin tinktoriell schwer abgrenzen, da sich auch das Hyalin nach der Weigertschen Methode stellenweise mitfärbte.

Seröses Exsudat konnte in diesem Stück nur an wenigen Stellen in geringen Mengen nachgewiesen werden. Die von Albrecht und Ghon zuerst beschriebene und in der Folge von allen Autoren bestätigte Verbreiterung der Alveolarwand durch hyaline Anlagerungen ist hier nicht wahrzunehmen. Die Verbreiterung der Alveolarsepten ist fast ausschliesslich durch die ausserordentlich starke Blutfülle und vielfache Schlängelung der erweiterten Alveolarkapillarien hervorgerufen, welche stellenweise buckelförmig in die Alveolarlumina hineinragen. Bisweilen sieht man frische Rupturen ihrer Wand, gefolgt von Blutung ins Alveolarlumen. Das Alveolarepithel zeigt reichlichste Desquamation.

Der Inhalt der Kapillaren besteht fast ausschliesslich aus wohlerhaltenen, dichtgedrängten Erythrozyten, zwischen welchen häufig Leukozyten wahrnehmbar sind. Die von Hassan Hamdi, Tsurumi, Fujinami und Wu in den Alveolarkapillaren gefundenen myogenen Riesenzellen wurden nicht beobachtet. Dagegen fanden sich in den Kapillaren beider

aus dem Hepatisationsgebiete entnommenen Stücke grosse, nach Kossel-Romanowsky dunkelblauviolett gefärbte Zellen mit grossen basophilen Granulis. Sie lagen in ziemlich beträchtlicher Zahl innerhalb des Lumens oder in der Wand der Kapillaren und wurden auch oft im Gewebe grösserer Lungensepten zwischen Gefässadventitia und Alveolarwand aufgefunden. Es handelt sich hier allem Anscheine nach um Mastzellen, deren zahlreiches Vorhandensein in den Alveolarsepten bei sekundärer Pestpneumonie bereits von Hassan Hamdi beschrieben wurde. Die in den Spätstadien der Krankheit häufig beschriebene Verlegung des Kapillarlumens durch hyaline Thromben, sowie irgend welche Ablagerung hyaliner Substanz an die Innenwände der Kapillaren war nicht zu bemerken. Pestbazillen waren im Blute der Kapillaren nirgends auffindbar.

Die alveolare Elastika war stellenweise vermindert, stellenweise wieder verdickt oder zerrissen. Im Alveolarinhalt frei liegend (Petin) fand sie sich nicht, wohl aber hingen einzelne zerrissene und bisweilen eingerollte Enden ihrer Fasern ins Lumen hinein.

Die kleineren Bronchien wiesen mehr oder weniger schwere Veränderungen auf. Das Epithel, teils der Basalmembran noch aufliegend, meist aber abgehoben, war manchmal gut erhalten. Die mit Schleimtropfen vollgefüllten, zahlreichen Becherzellen zeigten Degenerationserscheinungen. Im Inneren des Epithels und zwischen seinen Zellen wurden keine Bazillen angetroffen. Die etwas verdickte Basalmembran hat ein glasiges Aussehen, ist aber überall erhalten. Die Elastika zeigt keine Veränderungen. Die Submukosa ist stark aufgelockert und lässt in ihren zahlreichen Spalten an manchen Stellen Pestbazillen erkennen. Leukozytare Infiltration ist allenthalben vorhanden, auch vereinzelte Mastzellen werden angetroffen. Die in der Submukosa verlaufenden Blutgefässe sind stark erweitert. Ein paar in einigen Schnitten angetroffene Schleimdrüsenausführungsgänge zeigten in ihrem Inneren Schleim, aber keine Bazillen. (Schleimdrüsen waren in diesem Stücke nicht auffindbar.)

Im Bronchiallumen war anzutreffen: Abgeschupptes Zylinderepithel mit zahlreichen Becherzellen, meist in Gruppen und Streifen gelagert, Schleim und alle Bestandteile des Alveoleninhaltes. Die Bakterien waren stellenweise zu Gruppen vereinigt, während andere Gebiete des Lumens ausschliesslich von frischen Hämorrhagien erfüllt waren. Die Erythrozyten stellten bei weitem das grösste Kontingent des Bronchialinhaltes. Eine besondere Affinität des Bac. pestis zur Bronchialwand konnte nicht nachgewiesen werden.

Die Gefässe des hepatisierten Stückes sind erweitert und prall mit Blut gefüllt. In der Mehrzahl der Fälle weisen sie sonst keine Veränderungen auf. An einzelnen Stellen jedoch ist die Intima durch Schwellung und Proliferation ihrer Endothelzellen verdickt. In diesen Gebieten ist sie auch oft von polymorphkernigen Leukozyten durchsetzt und zeigt reichliche Desquamation ihrer Endothelzellen. Die genannten Veränderungen der Intima sind gerade an jenen Stellen der Gefässwand

zu bemerken, wo sich in den Lymphspalten der Media und Adventitia Bakterienansammlungen befinden. Die Intima selbst ist stets frei von Bakterien. Nirgends noch ist ein Durchbruch derselben in die Gefässe bemerkbar, obwohl die Bazillen stellenweise nur noch wenige Mikren vom Gefässlumen entfernt sind. Die Endothelzellen selbst sind meist unverändert; nur dort, wo der Zellverband gelockert ist, können an ihnen beginnende Degenerationserscheinungen wahrgenommen werden. Nirgends ist hyaline Anlagerung an die Innenseite der Gefässwand zu erkennen.

Die Media ist vielfach aufgelockert. Ihre zwischen den Muskelfasern gelegenen Spalten sind stellenweise angefüllt mit dicht aneinander gedrängten Bakterien. Bei schwächeren Vergrösserungen sind sie von den langen Kernen der glatten Muskelfasern kaum zu unterscheiden, weil sie zu schmalen, spindelförmigen Massen zusammengepresst sind. In diesen Spalten wurden auch häufig Leukozyten und bisweilen Mastzellen angetroffen.

Die Adventitia ist gleichfalls stark gelockert und ödematös, reich mit Leukozyten infiltriert und enthält in ihren Spalten bisweilen mächtige Bakterienlager. Mastzellen werden ziemlich häufig angetroffen. Die Gefässelastika zeigt nirgends Veränderungen. Die auffallenden Bakterienanhäufungen und die beginnende Hyalinanlagerung in den Nachbaralveolen der Gefässe wurden bereits erwähnt. Bakterien konnten im Blut der Gefässe nirgends nachgewiesen werden. Ebensowenig fanden sich Thromben der kleinen Gefässe and Kapillaren. Die Leukozyten innerhalb des Gefässlumens waren nicht auffallend vermehrt, bisweilen traten sie in kleinen Gruppen auf. Abgeschuppte Endothelzellen fanden sich manchmal in den Randgebieten dort vor, wo die Gefässwand, wie früher beschrieben, geschädigt war.

Das zweite aus der Mitte der hepatisierten Lunge entnommene Stück wies ähnliche Veränderungen auf wie Stück I.

Das Alveolarexsudat hatte die gleiche Zusammensetzung, nur überwogen hier die Leukozyten. Die Zellen des Exsudates zeigten viel häufiger als im Stück I hyaline Degenerationserscheinungen. Man sieht oft mehrere derartige Zellen oder Zelltrümmer miteinander verkleben. Vielfach liegen die so gebildeten Schollen nahe der Alveolarwand. Die Alveolarsepten erschienen durch stellenweise beträchtliche Hyalinanlagerung bereits deutlich verdickt. Die grösseren Gefässe, deren Wände dann und wann leicht hyalin entartet waren, zeigten manchmal stärkere Abschuppung ihres Endothels. Auch hier konnten Pestbazillen im Gefässblute nicht nachgewiesen werden. Nirgends fand sich eine Gewebsnekrose vor, wie sie für das spätere Stadium charakteristisch ist.

III. Teil eines grossen Bronchus samt anliegendem Lungengewebe.

A. Das dem Bronchus anliegende Lungengewebe ist zum grössten Teil lufthaltig. Es werden in ihm sowohl emphysematöse als auch atelektatische Stellen angetroffen. Das Alveolarlumen enthält Erythrozyten, die zum Teil in Zerfall begriffen sind, Epithel-und Staubzellen, eine

geringe Anzahl von polymorphkernigen Leukozyten, Bazillen und eine seröse Flüssigkeit. Hyalin wurde nicht angetroffen. Das Exsudat ist, wenn vorhanden, meist den Wänden angelagert. Die Alveolarmitte ist fast stets frei davon. Phagozytose der Bazillen durch Staubzellen konnte ziemlich häufig nachgewiesen werden. Die stellenweise in dichten Gruppen auftretenden Pestbazillen halten sich enge an das Exsudat, namentlich an die geschädigten Zellen desselben. Eine ausgesprochene Affinität zur Alveolarwand ist nicht wahrzunehmen.

In einigen Alveolen sieht man das abgeschuppte Epithel in körnigem Zerfall; Zellen mit ausgefranstem Rand, die abstehenden Zipfel bereits von Pestbazillen besiedelt, ferner Zellen, deren Kerne bereits pyknotische Veränderungen zeigen. In der Nachbarschaft ist der Zerfall schon vollendet. Man sieht nur mehr einen körnigen Griess, der zahlreiche Pestmikroben beherbergt.

Alveolen, die vom Bronchus nur durch ein dünnes, zwischen zwei Knorpelspangen gelegenes Stück seiner Wand getrennt sind, weisen grössere Mengen Pestbazillen auf. Andere Stellen, die von ihm weiter entfernt sind, sind nur spärlich von Bazillen besiedelt, manche sind ganz frei von ihnen.

Die Alveolarwand zeigt reiche Epithelabschilferung. Die Kapillaren sind mässig hyperämisch und enthalten in ihrem Blut zahlreiche Leukozyten, aber keine Mastzellen. Diapedese roter Blutkörperchen durch die Gefässwand konnte wahrgenommen werden. Die durch den Lungengewebsanteil des Stückes verlaufenden Blutgefässe sind stark gefüllt, doch frei von irgend welchen pathologischen Veränderungen.

B. Bronchus samt anliegendem Bindegewebe. Die Lichtung des Bronchus beträgt etwa 4 mm im Durchmesser. Das Epithel ist zum grössten Teil abgelöst und liegt in meist noch zusammenhängenden Fetzen im Lumen des Bronchus Dort, wo es noch an der Basalmembran haftet, sieht man ab und zu vereinzelte, interzellulär gelegene Pestbazillen. An anderer Stelle werden sie auch unter einer sich eben ablösenden Gruppe von Epithelzellen angetroffen. Diese selbst sowie die zahllreichen Becherzellen weisen die gewöhnlichen Degenerationserscheinungen auf. In ihrem Protoplasma fanden sich keine Pestbazillen.

Die verdickte, hyalinisierte Bowmansche Membran ist stellenweise ausgefranst, aber nirgends durchbrochen und enthält keine Pestmikroben. Die Bindegewebsbündel der Propria sind ödematös, gelockert, die Elastika vielfach zerrissen und zerfallen. Es konnten aber in dieser Schicht weder zwischen den glatten Bündeln der Muskelfasern, noch in den Spalten des Bindegewebes Pestbazillen gefunden werden. Die Blutgefässe zwischen Propria und Knorpel waren stark hyperämisch, aber sonst nicht verändert und frei von Pestbazillen. In dem genannten Gebiete waren Pestmikroben überhaupt nur in den zwischen den Gefässen verlaufenden Lymphspalten anzutreffen. Sie fanden sich einzeln oder zu Häufchen angeordnet an den Wänden und namentlich in den Buchten dieser Spalten.

Knorpel, Perichondrium und Muskulatur dieses Gebietes zeigten keine pathologischen Veränderungen. Das Bindegewebe war von zahlreichen Mastzellen durchsetzt. Die kleinen Bronchien, welche hier verliefen, zeigten starke Desquamation ihres Epithels. Sie enthielten Blut, aber keine Bazillen. Die zahlreichen Lymphfollikel dieser Gegend zeigten nur in einigen Spalten Bazillenhäufchen.

Die dem Lungengewebe bereits angrenzenden Lymphfollikel enthalten dagegen neben Kohlenpigment stellenweise beträchtliche Mengen von Pestbazillen. Die Schleimdrüsen des Bronchus sind stark katarrhalisch verändert und weisen in ihren Ausführungsgängen reichlich Sekret, aber keine Bazillen auf.

An den Randstellen einiger Schnitte ist die Wand einer den Bronchus begleitende grossen Arterie getroffen. Sie und ihre Vasa vasorum sind normal und enthalten nirgends Pestbazillen.

Das Lumen des Bronchus enthält Schleim, seröse Flüssigkeit, Gruppen abgelöster Endothelzellen, relativ spärliche Leukozyten, Alveolarepithel, Staubzellen und eine mässige Menge von Pestbazillen. Diese sind häufig zu Gruppen angeordnet und allenthalben zerstreut anzutreffen. Ein Teil liegt phagozytiert in den Staubzellen.

C. Das der freien Lunge entnommene Stück zeigt stellenweise die Erscheinungen des akuten vesikulären Emphysems; stellenweise sind Atelektasen vorhanden. Das Entstehen dieser Veränderungen mag wohl der Erhängungstod begünstigt haben.

Einige Alveolen sind angefüllt mit frischen Blutmengen oder sie enthalten seröse Flüssigkeit. Die Kapillaren zeigen starke Hyperämie, ihre Lumina sind von normalem Blut erfüllt. Ihre Wände sind nicht verdickt, nirgends sind hyaline Anlagerungen zu sehen. Die Elastika war stellenweise zerrissen.

Die in den Schnitten vorhandenen Blutgefässe, einschliesslich einer grossen Arterie und Vene, zeigen bis auf einen vereinzelten leukozytären Thrombus keine pathologischen Veränderungen. Hingegen waren zwei grössere Bronchien verändert. Der eine schmälere, mit zum grössten Teil noch anhaftendem Epithel zeigte bloss Erscheinungen akuten Katarrhs und wies reichlich Schleim im Lumen auf. Der zweite grössere Bronchus hatte Epithel nur mehr an einzelnen Stellen der intakten Basalmembran haften. Sein Lumen war erfüllt von Schleim, Epithel und einer frischen Blutung. In den Bindegewebsbündeln zwischen dem Bronchus und grösseren ihn begleitenden Gefässen fanden sich einzelne Mastzellen vor.

IV. Die Milz.

Sie zeigt starke Hyperämie der Gefässe und Hyperplasie der Pulpa. Polymorphkernige Leukozyten und grosse, oft mehrkernige Pulpazellen fanden sich ziemlich reichlich. Einige kleine Arterien wiesen hyaline Degeneration ihrer Wand auf. Nirgends fanden sich Pestbazillen.

Fassen wir die histologischen Befunde zusammen, so ergibt dieses Frühstadium der Lungenpest folgendes Bild :

1. Die Alveolen füllen sich rasch mit blutig-serösem und vor allem zelligem Exsudat, so dass bereits am ersten Krankheitstage ganze Lungenstücke hepatisiert sind. Die Bakterien sind in diesem Exsudate anfangs ziemlich gleichmässig verteilt. Bald zeigen sie jedoch auffallende Affinität zu jenen Alveolarwänden, welche kleinen Venen anliegen.

2. Phagozytose der Pestbazillen ist eine ziemlich häufige Erscheinung, die aber ausschliesslich in den Staubzellen sich vorfindet.

3. Die Exsudatzellen bestehen anfangs fast nur aus Erythrozyten, dann treten in grösserer Zahl epitheliale (Staub-) Zellen hinzu und schliesslich Leukozyten. Nach vollendeter Hepatisation machen letztere den Grossteil der Exsudatzellen aus. Ein Teil der anfänglich exsudierten Zellen weist Auffransung ihres Randes, gefolgt von körnigem Zerfall auf, wobei Pestbazillen in die abgelösten Teilchen einwandern.

4. Fibrin ist nur in vereinzelten Alveolen in reichlicher Menge vorhanden.

5. Die Kapillaren und Blutgefässe sind vollkommen steril und maximal mit Blut gefüllt. Die Alveolarkapillaren enthalten des öfteren auch Mastzellen. Vereinzelte Hämorrhagien infolge Reissens der Kapillarwand und reichliche Diapedese der Erythrozyten wurde wahrgenommen.

6. Die Blutgefässwände des erkrankten Gebietes zeigen an Stellen, wo die Pestbazillen in den Lympspalten bereits äusserst nahe an das Endothel vorgedrungen sind, Wucherung, Schwellung und Desquamation desselben. Nirgends aber wurde Einbruch der Bazillen in das Gefässlumen wahrgenommen.

7. Thrombenbildung in Kapillaren konnte nicht nachgewiessen werden.

8. Die Bronchien zeigen: Epitheldegeneration und-desquamation, Hyalisierung der Basalmembran. leukozytäre Infiltration und Oedem der Wände, muköse Degeneration ihrer Schleimdrüsen und manchmal Zerfall der Elastika.

9. Zahlreiche Mastzellen finden sich in den Lungensepten und im peribronchialen Gewebe.

10. Perichondrium und Knorpel der Bronchien wiesen keine pathologischen Veränderungen auf.

11. Die Milz zeigt akut infektiöse Hyperplasie. Sie enthielt keine Bakterien.

12. Hyalin findet sich in den Alveolarwänden, ferner in den nahe den kleinen Gefässen gelegenen Alveolen. Dort bildet es Schollen und Balken an bakterienreichen Stellen.

Weiter wird es in der Basalmembran der Bronchien und in den Wänden einzelner Lungen-und Milzgefässe angetroffen.

13. Im Gegensatz zu den Spätstadien der Erkrankung findet sich nirgend Gewebsnekrose.

14. Die im Gewebe angetroffenen Pestbazillen hatten die charakteristische Kokkobazillenform mit polarer Färbung, welche sie leicht annahmen. Die innerhalb der Gewebstrümmer gelegenen Bazillen waren meist kugelig, aber von normaler Grösse. Auffallende Involutionsformen zeigten nur diejenigen, die von Staubzellen phagozytiert waren.

15. Bakterien wurden im Lumen der Blutgefässe nirgends nachgewiesen. Dagegen fanden sie sich reichlich in den Lymphspalten ihrer Wand sowie in denen des peribronchialen Gewebes.

16. Ausser Bac. pestis wurden keine anderen Bakterien in den Geweben angetroffen (im Gegensatz zu den meisten Fällen derselben Epidemie, die in einem weiter vorgeschrittenen Stadium ad exitum gekommen waren).

Das von diesem Falle gewonnene spärliche Untersuchungsmaterial erlaubt wegen seiner Unvollständigkeit nicht, bindende Schlüsse über die Art der Verbreitung der Seuche im Organismus zu ziehen. Immerhin sprechen die schweren Veränderungen in den Alveolen und Bronchien bei diesem frühen Stadium der Krankheit für eine primäre Lokalisation des Pesterregers in den Luftwegen der Lunge.

Andererseits konnten keine Anhaltspunkte gefunden werden, die für eine Verbreitung der Lungenpest auf hämotogenem Wege (Kulescha u. a.) sprächen. Die Blutgefässe, namentlich die Lungenkapillaren, erwiesen sich allenthalben als steril, und die Veränderungen an den Gefässen waren, wo vorhanden, verhältnismässig gering.

Literaturverzeichnis.

1. Albrecht u. Ghon, Ueber die Beulenpest in Bombay im Jahre 1897. Pathologisch-anatomischer Bericht in "Denkschriften der kaiserlichen Akademie der Wissenschaft. Mathem.-naturw. Klasse 36, II. Teil, Wien 1898.

2. Bogutzky, Die Lungenpestepidemie in Harbin usw. 1910/11. 1915, Bd. I des Berichts der russ. wissenschaftl. Exped., S. 20—96 (russisch).

3. Chmara-Borschtschewsky, Die Pestepidemien im fernen Osten. Harbin 1912 (russisch).

4. Duerck, H., Beiträge zur patholog. Anatomie der Pest. Zieglers Beiträge, 1904, 6. Supplementheft.

5. Fujinami, A., Rep. Intern. Plague Confer. held at Mukden, 13. IV. 1911, Manila 1912.

6. Fujinami, A. u. Wu Lien-Teh, A Study of the Morbid Histology of the 1921 Manchuria Plague Epidemic. Reports of the North Manch. Plague Prev. Service, 1923/24.

7. Haffkine, P., Krankengeschichten von 44 Lungenpestfällen. Beilage des russ. wissenschaftl. Berichts, 1915, Bd. 1, S. 1—124 (russisch).

8. Hassan Hamdi. Ueber die histologischen Veränderungen der Pest des Menschen. Zschr. f. Hygiene u. Infektionskrankheiten, 1904, Bd. 48, S. 349ff.

9. Kitasato, S., Takaki, Shiga, K., Moryia, G., Bericht über die Pestepidemie in Kobe und Osaka vom November 1899 his January 1900, Tokio 1900.

10. Kulescha, G. S., Zur pathol. Anatomie der Lungenpest. Bericht der russisch. wissenschaftl. Expedition unter der Leitung des Prof. Sabolotny, 1915, Bd. 2 (russisch).

11. Lombardo, G., Sulla polmonite nei pestosi. Pathologica, 1922, Bd. 14, S. 498.

12. Petin, S., Pneumonia pestica. Wratschebnaja Gaseta, 1914, Nr. 36 (russisch).

13. Predtetschensky, S. N., Ueber die Bakteriämie bei Lungenpest. Bericht der russisch. wissenschaftl. Komm., 1915, Bd. 1, S. 109—111 (russisch).

14. Reports of the International Plague Conference held at Mukden 1911, Manila 1912.

15. Slatogoroff u. Padlevsky, Beobachtungen an Lungenpestkranken. Bericht der russisch. wissenschaftl. Expedition, 1915, S. 112—121 (russisch).

16. Slatogoroff, Zur Bakteriologie der Lungenpest in der Mandschurei. Bericht der russisch. wissenschaftl. Expedition, 1915, Bd. 2, S. 132—135 (russisch).

17. Signorelli, E., Sulle Alterationi Anatomo-Patologiche che il Bacillo della Peste, o la sua Tossino produce nei Polmoni. Lo Sperimentale, 23. V. 1913 (Ref. Trop. Diseases Bull., 1913, Bd. 2, S. 273).

18. Strong, R. P., Crowell, B. C. u. Teague, O., Studies on Pneumonic Plague and Plague Immunisation. VII. Pathology, S. 203—221 in The Phil. J. of Science. B., 1912, Bd. 7, Nr. 3.

19. Strong u. Teague, Studies on Pneumonic Plague and Plague Immunisation. V. Clinical observations, 1912, Bd. 7 S. 181—85, Bakteriology, ebenda, 1912, S. 187—202.

20. Tsurumi, M., Hara, C., Imai, M., Awoki, T., Sakamoto, T., An Investigation of Pneumonic Plague. The Japan Medical World, 1923. Bd. 3, Nr. 7/8, S. 153—160, 181—187.

21. Dieselben, Investigations on Pneumonic Plague. Dairen 1923.

22. Wu and Woodhead, Notes on the Histology of some of the Lesions found in Pneumonic Plague. J. of Pathol. and Bacteriology, 1914.

23. Wu Lien Teh, Reports of the North Manchurian Plague Prev. Service, 1918—1922.

24. Wyssokowitsch, W., Vorläufiger Bericht über die Resultate der nach Bombay entsandten russischen Pestkommission. Russky Archiv Pathologyi usw., 1897, Bd. 4 (russisch).

H. M. Jettmar,
M. D. (Wien),
Serologist.

FUNDAMENTAL ANTIPLAGUE MEASURES.

(Read before Chinese Eastern Railway Medical Conference 1925).

We deem it a privilege and honour to be invited to take part in this meeting and to read a paper on plague. It is to be regretted that our Director and Chief Medical Officer, Dr. Wu Lien Teh is prevented by unavoidable circumstances from attending in person, but he will be most interested to hear what is deliberated here.

The title of the paper as proposed by you is "Fundamental anti-plague measures." Before entering in a discussion of this problem it is necessary to make a few introductory remarks.

In considering the plague problem, our mind naturally turns to that well-known carrier of plague in this country, the tarabagan. It is, however, by no means the only wild rodent which suffers from plague epizootics and transmits the disease to man. We know at present of no less than 41 different species or subspecies which play similar roles in different parts of the world. There is, however, a marked difference between the other rodents and the tarabagan. Most of the former are very harmful to the crops; moreover their furs, fat, meat, etc., are of little use to the population, if at all. On the other hand, the tarabagan does no appreciable harm to the only two pursuits possible in the fields of Manchuria, Transbaikalia and Mongolia, namely hay-harvesting and cattle and horse-breeding; further the animal is extremely valuable for its fur, fat, etc., and its hunting is consequently of greatest economical importance. From this it is evident that measures for the fight of plague will have to be quite different in the tarabagan regions from those adopted in other parts of the world.

A few words may be said about the spread of plague from tarabagan to tarabagan and from tarabagan to man. Investigations carried out within the past years by the staff of the Transbaikalian Plague detachment and by ourselves have established the important part played by the tarabagan parasites: first the existence of living and virulent plague bacilli has been proved both in the tarabagan flea and the tarabagan louse by Sukneff and ourselves. Then Dr. Jettmar succeeded in transmitting plague from a sick to a healthy animal by means of the lice. Finally Dr. Wu Lien Teh and his collaborators managed to infect a healthy animal by exposing upon it a few fleas collected from a plague infected animal. The role of the fleas and lice is thus definitely proved and—inasmuch as both bite man—they spread the disease not only from animal to animal but certainly also from animal to man, though undoubtedly man is often infected directly when skinning or otherwise handling plague-infected animals. Another important point is that the lice and even some of the fleas do not have such a great tendency to leave the corpses and the skins as it is sometimes assumed. Dr. Sukneff and myself have found living

fleas and lice on skins which had already been folded and piled. There is little doubt that in those cases where persons who had not been in the fields but had merely handled tarabagan skins fell sick of plague, the parasites alone were responsible for the human infections.

Inasmuch as even some of the colleagues who have constant contact with us are not fully informed about the general organisation of our Service—judging from the questions which we have encountered from time to time—it may be well at this point to discuss shortly this Service. After the 1910-11 Manchurian Epidemic the Chinese Government convoked an International Conference in Mukden, which had to review the past epidemic and to recommend measures against further outbreaks. One of the recommendations of this Conference was to create a permanent Antiplague Service. The object of this Service was to continue research in the epidemiology and prevention of plague and to form at the same time a permanent centre of trained plague workers which would at once take up the fight with future plague outbreaks. According to this scheme our Service was founded in 1912. Dr. Wu Lien Teh, the chairman of the Mukden Conference, has since that time been the Director and Chief Medical Officer of our Service. Our Service is directly under the control of the Ministry of Foreign Affairs at Peking; its funds are derived from the Customs revenue. That the recommendations of the Mukden Conference were sound and that our Service has proved its usefulness may be gleaned from the fact that whereas 60,000 plague deaths occurred in the 1910-11 epidemic in Manchuria, only 8000 persons succumbed to plague in the 1920-21 epidemic, and this in spite of the tremendous increase in population during this interval of a decade. Our Service maintains five hospitals in North Manchuria (Harbin, Manchouli, Sansing, Lahasusu, Taheiho). The Government Hospitals in Tsitsihar and in Hailar are not directly controlled by our Service, but they are in close co-operation with it. The important Hospital at Hailar especially, the Chief of which is a former pupil of Dr. Wu, may for all practical purposes be considered as one of our own hospitals.

Among these hospitals, those at Hailar, Harbin, and Manchouli are specially important for the fight against plague. They deserve therefore a short description :

(a) *The Harbin Anti-Plague Hospital.*

I may say that our Central Hospital in Harbin is amply provided for the fight with any epidemic. It consists of two totally separated compounds, one for administration, general hospital purposes and laboratory, the other for infectious patients. The laboratory in its turn can in case of an epidemic be totally isolated from the other blocks of the first mentioned compound. The laboratory is so provided that it can not only carry out all the work which may become necessary in Harbin, but that it can equip also several field laboratories. The Harbin Hospital possesses also the necessary personnel for those purposes; all the

six doctors attached at present to it have both clinical and bacteriological training; five of them have served in plague epidemics.

The isolation compound has a capacity for 200 patients; the necessary equipment for them and a more than ample amount of disinfectants etc. are ready in our stores. In the next spring a welcome addition will be made : it is proposed to erect two new isolation blocks. One of them will be fitted according to the latest ideas for the clinical observation and the treatment of plague patients with the maximum of comfort to them and the maximum of protection of the staff; the second will be so constructed that it may serve as well for the treatment of patients with cholera or other infectious diseases or as a suspect ward.

(b) *The Government Hospital at Hailar* :

This Hospital is situated on the outskirts of the city. It consists of three totally separated blocks so that it would be easy to have plague patients isolated. The hospital has a well equipped laboratory and a sufficient and well trained staff.

(c) *The Anti-plague Hospital at Manchouli* :

This hospital consists at present of two blocks lying at a short distance from one another. One accommodates the administration and the laboratory, the other serves for hospital purposes. The first block is very well suited for its purpose; the laboratory can be totally isolated from the rest of the building and has ample space for plague work; we carried out there our flea experiments with safety and ease. The hospital block, while serving well for ordinary purposes, could not very well at the same time be used for accommodation of plague patients, so that whenever there are suspicious or plague cases, the ordinary work has to be suspended. This is certainly a drawback, but I can tell you that there is every hope that for the next summer another arrangement will be made, which will create good accommodation for suspicious or plague patients. I can give you at present no details, as different schemes are under consideration.

Our organisation works in close co-operation with the other local institutions and colleagues; I will return later on to this point. It has direct connection as well with the organisations of almost all countries where plague exists, especially with those where wild rodents are the cause of the epidemics. It is specially necessary to speak of our relation with the Anti-Plague organisation in Transbaikalia. As you know perhaps, two years ago a Conference took place at Chita where the plague problems were discussed. It was not possible to conclude at that time an official agreement but it was arranged that the two organisation would inform one another at once of any plague outbreaks which might occur in their territory and would as far as possible co-operate in practical and scientific directions. This agreement is still in force. I would like to remark specially that we have travelled since then repeatedly to Transbaikalia and that we cannot find words enough to express our thanks for the kindness and helpfulness of our colleagues. The esteemed Prof.

Barykin made during his last stay at Harbin two communications to Dr. Wu, which were very welcome: He informed him, that the sphere of activity of the Transbaikalian Antiplague Organisation will be considerably enlarged in every respect. It is proposed to nominate a new plenipotentiary for the fight with plague and to choose an experienced plague specialist for this post. This plenipotentiary will be directly under the Commissariate for Public Health in Moscow so that he will be able to act quite independently. Prof. Barykin expressed at the same time the hope that the relation between the Russian and our organisations would not only continue but become more close. He proposed that a new Conference should be held next spring which— if possible—should result in an official agreement, codifying co-operation both in practical and scientific matters. Dr. Wu Lien Teh was very glad to hear this. It was arranged that immediately after his return to Harbin preliminary negotiations would be started to have this Conference in May, 1926.

We can turn now to the concrete measures taken against plague. As you all know, the plague problem in Manchuria has entered this summer a new stage. Since the 1920-21 epidemic the Chinese authorities have prohibited the hunting of the tarabagan and the trade in and transport of the skins. This ban is lifted now and the trade with the skins, which has such a tremendous importance for the economic life of the country, is now lawful. When the ban was lifted Dr. Wu Lien Teh made certain recommendations to the authorities which were accepted by them. I herewith give a summary of them:

The control of the tarabagan trade is in the hand of special bureaux. At least two such bureaux should be established, one at Manchouli, the other at Hailar. These bureaux will be associated with the Plague Prevention Service. The local representatives of the Service (i.e. our Medical Officer at Manchouli and the Chief doctor of the Hospital at Hailar) will act as chief medical consultants and executives.

The principal functions of each bureau are:

(1) Any person who wishes to hunt tarabagans or to deal with their skins must apply to the bureau. If passed by it such persons will get a license and their names will be entered in the lists kept by the bureau.

(2) The bureau will issue instructions to the licensee to carry out his trade with safety.

(3) The licensee must submit himself to inspection by the bureau. The hunters especially must report themselves to the bureau before and after returning from hunting trips to be examined medically.

(4) The bureau will have proper facilities for receiving and disinfecting skins with the latest and best methods. Fixed charge to be made for disinfection.

(5) Mounted patrols to be employed for inspecting country where hunting goes on in order to help hunters, see that orders are carried out, prevent smuggling, and detect tarabagan and human plague.

(6) The bureau will be equipped or will be associated with proper laboratories so that suspicious skins, animals or human cases may be examined without delay.

Point two of these regulations deserves special discussion :

Immediately after the ban on the tarabagan trade had been lifted, an illustrated Chinese booklet was prepared by our Service which—written in simple language—contains information for those in the tarabagan trade, in the first line for the hunters. I am going to distribute some copies among you. We have also made a Russian translation of this booklet so that those interested may get fully acquainted with its contents.

The summary of important facts given at the end of the booklet may with advantage be quoted here :

(*a*) The tarabagan is a reservoir of plague.
(*b*) Because its skin is valuable you should not forget the danger of catching plague from it.
(*c*) Precautions against sickness are very easy :
  i. Avoid sick animals and infected regions.
  ii. Report to the authorities when you see any sick animals or carcases.
  iii. Wear leather gloves whenever possible during skinning.
  iv. Tie up your coat sleeves and neck bands to avoid flea bites.
  v. Use a few drops of spirit for disinfecting hands after every skinning operation.
  vi. Dry the tarabagan skins thoroughly in the open air.
(*d*) In case of sickness report to fellow hunters and proceed at once to nearest hospital or police station.
(*e*) Greatest danger in plague is when a man coughs up blood from his lungs. Everyone engaged in attending or transporting such patients must wear cotton masks, as shown in the picture.
(*j*) To come near a coughing patient without masks means certain death.

We hope that this booklet to be given to every Chinese hunter or trader together with his license will prove useful.

It would be very desirable to have also a booklet in Russian language for the Russians. We think that with a few changes our booklet would be suitable for this purpose. We would be very interested to hear your view upon the necessity of such a Russian booklet and to see whether the Chinese Eastern Railway is interested in the edition of it.

Undoubtedly besides this instruction for the most concerned, other means of educational propaganda are necessary. We consider a leaflet containing information for the population at large should be posted in public places, in the stores of tarabagan dealers, in the houses of the hunters, etc. It should be given also to the schools to be read and explained by teachers, and distributed whenever lectures on public health are given. Again, it would be very desirable to have this done both in Chinese and Russian language and we would be interested in your views on this point. I append a draft for such a leaflet.

The greatest obstacle to carry out all measures for controlling the tarabagan trade is not in the centres at Hailar and Manchouli but in smaller stations and open country. Every means has been taken by dealers to evade the formalities and taxes, and undisinfected skins are secretly dispatched by freight or by post from small stations. The Railway now accepts no skins for transport without proper disinfection certificates. The postal authorities agree to the same and will not accept parcels outside Hailar and Manchouli. This point has constantly our closest attention. The difficult problem of controlling the skin trade is only one of the many activities of the Antiplague Service. While at Hailar and Manchouli all facilities are provided for recognising suspicious cases and coming quickly to a final diagnosis, this becomes more difficult the further away a locality is from these two centres. Every attempt will be made to induce the population itself to report suspicious cases or through the police; special instructions will be issued in this respect to the latter. An important role is naturally played in the early detection of plague cases by the medical personnel (feldchers etc.) in the out-stations, many of whom are Russians. It is very important to devise means by which this medical personnel, part of whom is probably not well acquainted with plague, could be informed of the necessity and means to make an early diagnosis of plague and to report such true or suspicious cases at once. We would be very glad if this point could be discussed here to-day.

If there are any suspicious or true plague cases among the railway personnel, they are as you know accommodated in the railway hospitals : all the others will be admitted into appropriate hospitals. Naturally in all cases other necessary precautions will be taken by the proper authorities, like observation or quarantining of the contacts, disinfection of the houses of the patients, and if necessary observation of the whole settlements and measures of general quarantine.

The Railway and our Service have always worked shoulder to shoulder, informing each other of any cases, co-operating when necessary. Permit me, however, to touch on one point, in regard to which possibly an improvement could be made. I can best explain what I mean by giving you an example : Two years ago an extremely interesting case occurred in Transbaikalia. Two men were simultaneously infected while tarabagan hunting. One of them developed bubonic plague, the other apparently primary lung pest. Now persons who contract primary pneu-

monic plague directly through contact with infected rodents, are extremely interesting from a scientific view point, and it is very desirable to investigate them by all possible methods. In the present year a similar instance was reported from Hohonte. Our Medical Officer at Manchouli was at once informed of the cases by the railway doctor, but when the information reached us here, the patient had already died and post mortem had been made. We have not missed much in this case because, as we learnt afterwards the patient had only secondary pneumonia. But future cases may occur and there are many other questions of great importance which could be investigated if the laboratory experts could reach the infected localities as soon as possible. In the case when our busy colleagues in the laboratory of the central hospital cannot easily leave their post, our Service can always dispatch a bacteriologist at the shortest notice who would gladly assist you in your work and would at the same time carry out scientific investigations.

Thus, I think, matters could be easily arranged to our mutual advantage and to the benefit of science.

I have nearly reached the end of my remarks. As stated earlier, with the lifting of the ban on the tarabagan trade a new era has begun in the fight with plague. We must see how the new system will work. You can be convinced that our Service will keep a close watch on it and try to improve it whenever possible. This will be done not only by practical observation but by continued research work. It is planned to send out this summer an expedition from Harbin, which will mainly study two subjects :

1) It will visit the tarabagan districts in Manchuria, especially those north of the Railway line, to get acquainted with the general situation there and to determine the northern border of the district inhabitated by the tarabagan. This is equally important from a theoretical as from a practical view point.
2) It will study further the disinfection of tarabagan skins, especially the efficiency of the disinfection in regard to parasites.

We are far from asserting that those are the only two questions which have to be investigated, but they are two of the most urgent ones.

We hope that other questions will be discussed in general at the coming Conference with our Russian Colleagues and that perhaps a program of scientific work to be carried out partly by each organisation separately and partly by both jointly, will be agreed upon. This will again advance both theoretical and practical knowledge. I mention only one point which is still unsettled, namely whether in infected areas, only hunting should be prohibited or whether active measures should be taken to destroy the rodents living there. This question can be decided only when a number of still unsolved preliminary problems has been investigated.

It is undoubtedly a good thing that the ban on the trade has been lifted, not only from an economic view point but also from the medical

one. At least we do not have to fight now against secret hunting and smuggling of skins, but can control lawful pursuits and can urge the population to help us in their turn. Nevertheless our difficulties are great and they can only be overcome when all organisations work hand in hand for the common goal. We are convinced that you will co-operate with us in future as you have done in the past.

Conclusions :

1) The tarabagan is the principal if not the only reservoir of plague in our country. The disease is spread from animal to man either through direct contact or through the parasites (fleas and lice) of the animal. Infection may be contracted by mere contact with the furs of the animals.

2) The recent lifting of the ban on the tarabagan trade has created a new situation in the fight against plague in Manchuria. New measures have been devised to meet this new situation. They consist mainly in the erection of special bureaux at Manchouli and Hailar which are associated with the M.P.P.S.

3) The principal functions of the bureaux are :
   a) Licensing of tarabagan hunters and skin dealers.
   b) Instruction, how to carry out their occupation.
   c) Medical supervision of the hunters and dealers, their houses and stores.
   d) Providing for quick and proper disinfection of the tarabagan skins.
   e) Providing mounted patrols which will inspect the country in order to assist the licensed hunters, to prevent illicit hunting and smuggling of skins, to detect tarabagan and human plague and to prevent hunting in suspicious or infected districts.
   f) The bureaux will be equipped or will be associated with proper laboratories for a quick diagnosis of plague.
   g) General education campaign among the population at large.

4) To carry out the anti-plague program as fully as possible, it is necessary that the sanitary staff of the Railway and our organisation on one hand, the Transbaikalian Antiplague Service and our Service on the other hand work in as close co-operation as it has been the case up to now.

5) Moreover it is imperative to interest the practising medical men, especially those in the outstations, in the necessity of diagnosing plague at once and to instruct them in this respect as far as this is necessary.

6) Beside the practical side of the fight against plague scientific questions must not be neglected which in their turn will lead to more complete and thorough practical methods.

R. POLLITZER, *Bacteriologist, P.P.S.*

NEW PNEUMONIC PLAGUE WARD, HARBIN 1926.

(*With one illustration and one photo.*)

Among the resolutions passed by the International Plague Conference of Mukden 1911 was the following :

> 'The need for isolation of pneumonic plague patients being urgent, permanent isolation hospitals should be available. Such isolation hospitals should admit of individual isolation, be of rat-proof construction, and be capable of easy disinfection. In the grounds of such isolation hospitals ample space should be provided for the construction of additional emergency wards, for which purpose the size should be prepared and foundations laid. The provision of ample air space and light is desirable.'

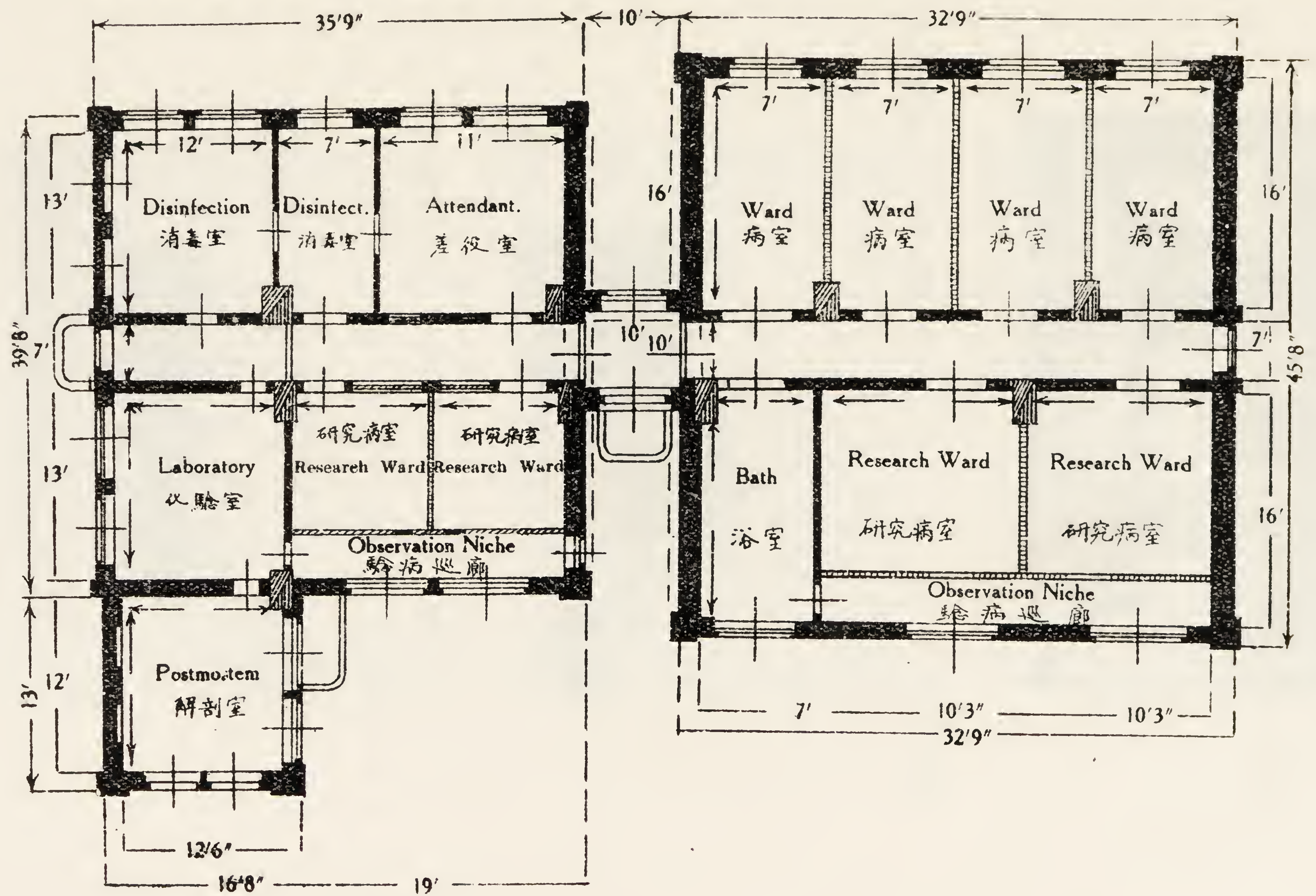
It will be seen that very few details were given as to method of construction of a pneumonic plague ward. In the summer of 1912, when building operations for the new plague prevention hospitals were hurriedly started, three of the five plague wards were so designed as to admit of individual isolation, but owing to the lack of sufficient cement at the time the floors were all made of wood. In each unit is a long corridor, four feet wide, from which a series of twelve doors open into their respective cubicles, each with its own outside window. A small glass window, one foot square, is inserted in each door to enable the nurse or attendant to watch the patient from the corridor. The physician or nurse attending the patient must enter the chamber and thus be exposed to great risks and discomfort.

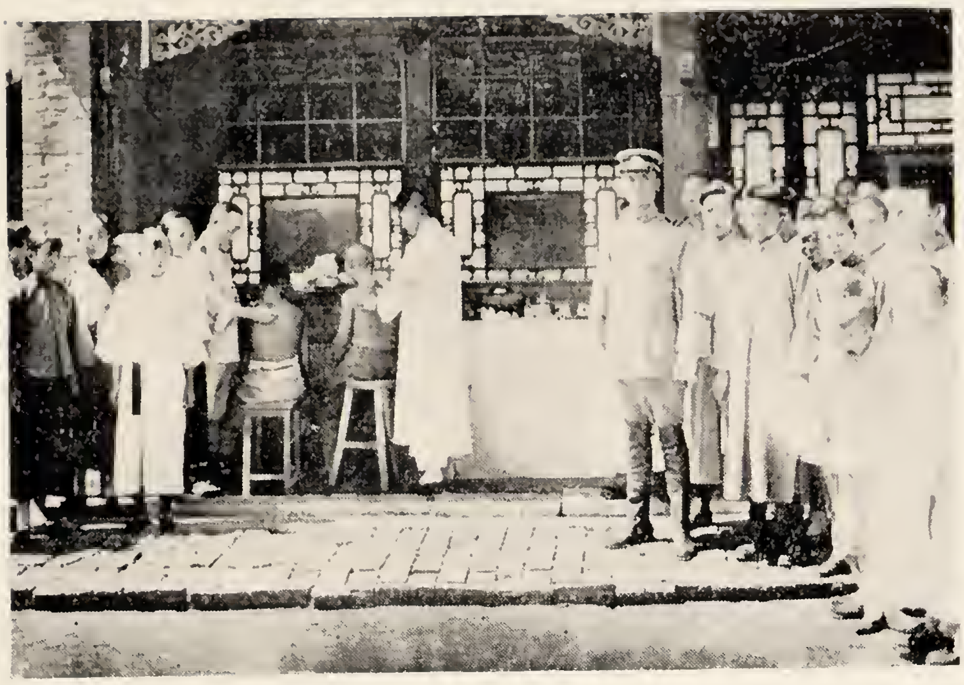
In our new pneumonic plague ward constructed in 1926 we have obviated the above weak points and added several improvements for investigation and research, so that this new building may be considered as near a model as any such can be. A description now follows :

The new building is rectangular in shape, 78½ feet long, while the breadth has a maximum of 55 feet and a minimum of 46 feet. Foundations are 7 feet deep. Two entrances lead into the building. The first, patients entrance, (in the center of its longest part) opens into a square corridor (10 × 10 feet), from the left of which a passage leads to the attendant's room and two disinfection rooms on one side and two research wards and the laboratory on the other. These rooms can also be reached from the second entrance at one end of the long corridor by the medical staff. From the laboratory a door leads to the postmortem room and thence into the separate exit. Between the laboratory and postmortem room is a sliding glass window, similar to that often seen in an operating theater for communication between workers on the two sides. The floors are all constructed of cement slabs on a crushed

GROUND PLAN, NEW PNEUMONIC PLAGUE HOSPITAL, HARBIN 1926.

模範的肺疫病室(哈爾濱東三省防疫總處院內一九二六年落成)之平面圖





Performing mass anti cholera vaccinations at Newchwang, where over 22,000 injections were given out of a pop. of 95,000.

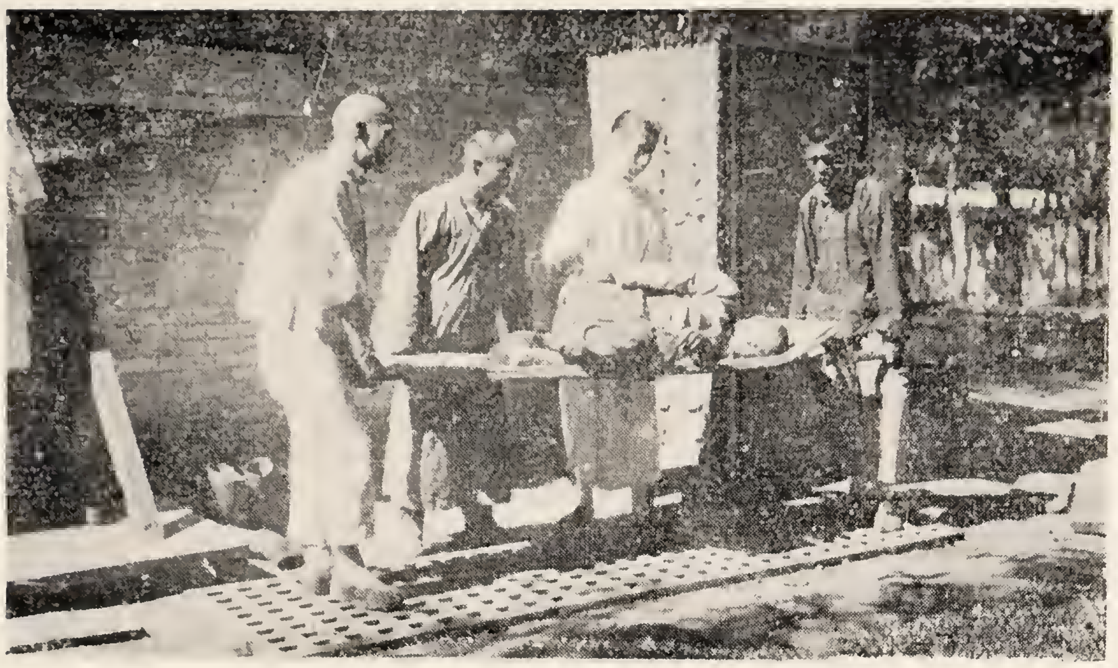
示在牛莊接種市民霍亂禦防液計市民九萬五千共種二萬二千名

Quarantine doctors at Newchwang boarding a steamer from Shanghai during cholera epidemic 1926.

示在牛莊海口檢疫院檢驗由上海來之輪船狀況

Dr. E. B. Yang (Newchwang) with Police proceeding to inspect vessels arriving from south.

示牛莊楊廷光醫官帶同警士從事檢驗南來輪船之狀況



A cholera patient being carried into Pinchiang Hospital, 1926.

霍亂病人入院治療之狀況

Admission routine for cholera patients in the compound of Pinchiang Hospital.

入院時露天檢查之狀況

The staff of Pinchiang Hospital receiving anti-cholera injection.

助手院役實行注射霍亂禦防液時之狀況

Making simple diagnostic tests in the compound during cholera epidemic 1926.

示一九二六年哈爾濱霍亂流行時在露天診斷之狀況

The technic of hypertonic saline infusion.

示施行霍亂病人食鹽液注射治療法

A big coastal junk from Ningpo being inspected by quarantine doctors at Newchwang 1926.

示霍亂流行時風船由寧波到牛莊時健康檢驗時之狀況

brick base. The windows are all very large :—4 measuring 7 ft. by 4 ft. 8 in.; 3 meas. 7 ft. by 5 ft. 8 in.; and 13 meas. 7 ft. by 4 ft. Total 20 windows.

Each of the four big cubicles for a plague patient is 7 feet wide by 16 feet long and 11 feet high. The most interesting features of this new Pneumonic Plague Hospital are :

(a) The adjoining *Laboratory and Postmortem Room*. Where the course of disease is so rapid, every minute saved is important, and the presence of the laboratory side by side with the wards will enable the medical staff to prepare all materials for diagnosis and treatment on the spot. When a patient dies, the same facilities for investigation are also at hand.

(b) *The observation niche,* measuring five feet wide and separated from the individual cubicles by a wide glass partition, which reaches as far as the ceiling. The advantages of this niche are :

i. The physician can observe and conduct investigation upon the patient at all times without being in the same room and breathing the same air.

ii. By means of a small sliding glass pane in the partition three feet above the floor, the patient's arm can be extended into the niche for blood examination, serum injection etc. without risk to the physician. There may even be no need for him to wear a mask since complete security is assured without hindering any view.

iii. The partitions dividing the cubicles can be removed at a moment's notice so as to form a large room for saline injection in the treatment of cholera cases.

The addition of these two niches in the new Plague Ward, one through the laboratory and the other through the bath room, will no doubt further facilitate any investigation upon pneumonic plague patients that we may desire when the next epidemic breaks out.

Y. M. Kwan,
Assistant Medical Officer.

NEW ASCARIS FOUND IN THE TARABAGAN (Ascaris sp. nova). (WITH ONE ILLUSTRATION)

(From the Branch Laboratory of the Manchurian Plague Prevention Service, Manchouli).

Every since 1922, when the first specimen of Ascaris was detected in the Tarabagan (*Arctomys bobac*), I have examined several dozens of the bobac (both living and dead), but have succeeded in obtaining up to date only nine specimens. During some months, not even one parasite was found, the reason for which is hard to give. In one animal I gathered six worms, of which two female and one male are now in our museum. Unluckily the tail of our only male specimen was decomposed, so that the anatomy could not be properly studied. During the last three years, no fresh worms have been discovered.

The body of the worm is grayish-white in colour. The head is provided with three lips, one upper and two lower; the papillae are relatively large. The cephalic extremity is much different from that of *Toxastrus limbatus* as found in dogs and cats, the head in the latter case being provided with membranous wings.

On the other hand, the ascaris of the tarabagan has a shape resembling in general that found in the human intestine. But the caudal extremity of the female is papillar—a feature different from any hitherto described.

A. *First male ascaris.* 8 cm. long, 2 mm. at widest part. Thinner and shorter than female. It was decomposed when found, so that anatomy is not quite clear.

B. *Female Ascaris.* 10 to 17 cm. long, 2.5 to 3 mm. at widest part (two specimens). The vulva is located at the anterior fourth of body. Its prominence can be seen with naked eyes. Microscopically, it looks like an over-turned earthenware mortar, concave in the center, thus forming a round cavity. The ovaries of the human ascaris look like a spiral tube winding round the body. In ascaris sp. this is missing. The papillar shape of the tail is also peculiar, since the tip, where the rectum opens, is surrounded by spiral muscular tissues for elongation and contraction. The connection between the vagina and uterus can be clearly seen under the low-power microscope. Otherwise, the features are much the same as in human ascaris.

C. The eggs are gray in colour and not different to those of the human parasite. In the feces of the tarabagan, we found ripe ova, 60-66 mm. long and 48-54 mm. wide. The measurements of ten ova examined are as follows :

length	66,	60,	66,	60,	63,	66,	60,	66,	72,	66mm.	Av.	64.5mm.
breadth	54,	50,	54,	48,	54,	48,	52,	60,	54.	54mm.	Av.	52.8mm.

From the first group of 47 tarabagans we obtained 14 parasites (1922).

From the second group of 19 tarabagans we obtained 1 parasite (1923).

From the third group of 50 tarabagans (3 years) we obtained 0 parasites (1924-6).

Cultivation of Ova.

We began to cultivate eggs from October 6, 1922. This was done by placing the feces of the tarabagan mixed with water in a conical glass. After breaking up the hard pieces, the contents are allowed to stand. Then the upper clear layer is poured off. This is repeated 20 times. Finally, only a little feces containing the eggs is left at bottom. A little of this is withdrawn by means of a pipette and placed on a brick, choosing a concavity so as to prevent its running out. Sufficient water is added and the whole brick is placed on a tray. Proper dampness is maintained and the hatching of the eggs watched. Results :

Oct. 9. Inside of ova divided into 2 or 3 parts.

Oct. 11. More subdivision into more than 6 parts. The Japanese call this stage the mulberry period.

Oct. 26. Some of the eggs show young parasites.

Nov. 3. Every egg envelopes a complete parasite.

The embryos appear very lively inside the shells but are unable to break the shell and thus escape. This follows the general rule of other ascarides. The hatching apparently required 29 days from beginning to end. In warmer weather this should take 14-16 days, but Harbin and Manchouli are pretty could in October and November.

After this, I was engaged upon other investigations and several days were lost. On my return the embryos had all died. Thus ended my second investigation. Summarising, I may say :

1. The Ascaris sp. a new species, is found in the tarabagan.

1. The Ascaris sp., a new specits, is found in the tarabagan. family.

Li Yuan Po, M.D.

Parasitologist M.P.P.S. Manchouli.

A MONGOLIAN CHIEF'S DESCRIPTION OF THE TARABAGAN.

[*Editor's note.* In order to obtain first hand knowledge of the tarabagan from all sources, I approached Commissioner Ch'eng Teh Yuan Chai, Resident Diplomatic Officer for Mongolia at Hailar, in the summer of 1926, for his views regarding this animal and the history of plague among his people. The following is a translation of his text written in excellent Chinese.]

The tarabagan is a member of the rat family found everywhere in Mongolia north of the desert, but not in the south. It emerges from its burrow, after snow-melting in the spring season to search for food. This consists mainly of roots, particularly dew-wet grass. It never drinks water hence the name hant'a or dry otter. The female produces 2-3 or 4-5, at most 6, in May or June (old style calendar) every year. In the frost season, the animals enter their holes in multitudes. One interesting feature of the tarabagan's life is that there is a working tarabagan in every hole which digs holes and gathers grass for the family. Hunters usually find this tarabagan to be thin and poorly furred, with worn-out front paws and lack of hair at the sides. By these signs, they know at once which is the working slave, much resembling our human slave. The other animals are fat and richly furred. The Mongols catch them in the summer, and the flesh is much eaten by rich and poor alike. In the late summer the skins are most valuable and worth 1 to 2 taels ($1.½—3) per piece. The price has reached as high as $5 recently. In the 19th year of Kwang Su (1893) near and along the *Chalanor* station, a Mongol name Itamuchepu caught a diseased tarabagan and ate its flesh, and this resulted in his death and that of his whole family. The contagion spread to 30 odd neighbouring families and killed some few hundred persons altogether. This dangerous form of plague had never been known before that year. The diseased persons were marked by having their faces turned bluish or black. They had high fever, and also spat blood. The sickness was incurable, the victims usually dying within 12 hours.

Some lamas invited to the religious offerings were themselves infected. Among the 30 odd families attacked in 1893 only two girls of 6 or 7 years old escaped and are still living. After this plague, the Mongols began to take precautions while catching tarabagans. In the 6th moon of 31st year of "Kwang Su" (1905) at *Malakatala* 4—5 Mongols of the Paerrbu clan and named Chinchiyen hunted down some diseased tarabagans and ate their flesh. As a sequel over 20 persons died of plague. Their neighbours moved away at once, and thus the disease did not spread very far. In the following year (1906), at a place north of Malakaerrh near Lake Haranor 3 Mongols of the clan Old Paērrbu named Kulachi caught some sick marmots and ate them, and

this resulted in over 10 deaths. The neighbours moved away, so the deaths were again few. The year after that (1907) at *Tanikuerrh* a few Mongols named *Tochin Sayenmo* caught one tarabagan with their dogs and ate it, resulting in 5 or 6 deaths. The neighbours also shifted quarters and thus cut short the outbreak. In the 2nd year of "Hsuan Tung" (1910) a great plague started at Manchouli. This epidemic killed some hundred Chinese labourers locally but spread to the Chinese Eastern Railway, Kirin and Fengtien and caused the deaths of over 50,000 inhabitants. The epidemic covered an area many thousand lis (Chinese miles). The distress on this occasion was very great. In the 9th year of the Republic of China (1921) this same plague appeared again and spread to Harbin and vicinity. The activities of the Chinese organised Antiplague services fortunately prevented its extensive spread.

3. The above are in my opinion the true reports of the history of the lung plague. The following are the tarabagan producing districts :—

1. North of Hulun sea and south of Manchouli from *Meiyu* on the east, up to outer Mongolia on the west produced the most animals for hunting in the past. These regions are mostly denuded of tarabagan now.
2. Along the south shore of the river *Maerrh-humo* (boundary of China and Russia) east of Abagaitui (Kulun) as far as *Fukutog-nopo* on Argun River (south) is the second center. Here also the tarabagan is now scarce.
3. Along both sides of Malakaerrhu river up to Terniho is the third region, but not so much as the first two places. Everywhere the tarabagan is getting scarce because of the excessive hunting. Besides these places, there are smaller and more distant centers but they are too numerous to mention.

CH'ENG TEH YUN CHAI,
Resident Commissioner of Foreign Affairs for Mongolia, Hailar.

PRELIMINARY REPORT ON THE CHOLERA EPIDEMIC OF 1926.

GENERAL SURVEY.

About the middle of May information reached us that a few cases of Asiatic cholera had occurred among residents of the Chapei District in Shanghai, but nothing official was declared until June 8, when the Settlement authorities reported their first authentic case of cholera which had been admitted into hospital four days previously. From that date onwards the infections began to accumulate until the summit was reached about the week August 1-8, during which 2481 cases were reported as having been treated at the two Chinese Summer Diseases Hospitals. Altogether no less than 20,000 cases have occurred in the Shanghai district alone. Serious outbreaks were reported in almost every city in the Yangtse area such as Nanking, Soochow, Wusieh, Huchow, Anking, Hankow, Wuchang, etc. as well as further south in such centers as Foochow, Amoy, Swatow, Canton, Hainan, etc. The country of Siam reported 5000 in deaths alone.

It may be remembered that a similar outbreak of cholera, affecting several thousand victims, occurred in Shanghai the year previous (1925). I happened to be then in that city in August and secured samples of water from the Chapei Water-works (Soochow creek, filter-beds and tap) and requested the Municipal Health Laboratory to make a bacteriological examination of same for cholera. The report was that although suspicious vibrios were cultivated from every sample they were probably not of the pathogenic variety. In July of this year, when the cholera situation was becoming acute, Dr. Noel Davis, the Health Commissioner, had samples of the Chapei Water-works bacteriologically examined and reported that in every one (intake from Soochow creek, effluent from filter-beds and a tap from the mains) specific cholera vibrios were isolated. Much acrimonious controversy has since arisen because of that discovery, but it seems to me that the real problem before the health authorities of the International Settlement and Chinese Area is effective co-operation in

(*a*) An intensive study of suspected sources throughout the year, including water, carriers, etc.
(*b*) Early preventive measures to be undertaken early in the spring.
(*c*) Mass prophylactic inoculations.
(*d*) Early notification to non-endemic centers, so as to limit the spread to other localities.
(*e*) Other problems, e.g. mass fecal examination at ports, railway centers.

No unprejudiced person will deny that the present loose laws regarding notification and quarantine, which were probably devised half a century ago, need urgent revision. For the sake of all concerned, in-

cluding the various foreign authorities and commercial bodies in China, it is hoped that a Cholera Prevention Conference will soon be held in or near Shanghai so that all cards may be placed on the table and really effective preventive measures may be devised against this almost yearly visitation of an easily controllable disease.

Should a proper system be established, such incidents as when the British steamer Lienshing tried to smuggle a dying cholera patient ashore on August 3 might not occur. A fine of $250 was meted out to the captain besides 12 months rigorous imprisonment to both the first and second compradores.

We may now proceed to a study of the epidemiological and clinical data before us. As has been said above, the first case was officially declared in Shanghai on June 8, though it was clear that isolated cases had occurred since the middle of May. A state of epidemic was not reported until July. In the meantime, ports in Chekiang, Fukien, and Kwangtung as well as the Yangtze valley had been invaded. The first cases apparently did not reach the northern cities until the third week of July, though Tientsin reported its first case on June 15. The following table showing (a) when quarantine was first declared at various northern cities and (b) when the first case occurred in them respectively, is highly illuminating :

Locality :	Quarantine declared against Shanghai :	First cholera case :	Quarantine stopped :
Dairen	July 22	Aug. 28	Oct. 11
Antung	,, 29	Sept. 7	——
Newchwang	,, 19	Aug. 19	Oct. 10
Tsingtao	Aug. 9	Aug. 6	Oct. 15
Japan	,, 2	Aug. 3 (S. S. Macedonia)	——
Tientsin	——	June 15	——
Harbin	——	Aug. 5	Sept. 15
Port Arthur	July 22	Aug. 27	,, 24
Changchun	——	,, 14	Sept. 18

The Japanese authorities at Dairen enforced fecal examination of passengers and crews of steamers arriving from infected ports on July 22. Up to September 30, they had examined

259 steamers with crews totalling	15,314
548 junks ,, ,, ,,	3,091
Passengers male	18,829
,, female	2,861
Total	40,095

The South Manchurian Railway authorities also enforced fecal examination of railway passengers arriving from the north from Aug. 23; this was stopped on September 18.

The above table shows among other things :

(*a*) That quarantine measures were in most cases applied much too late,

(*b*) That even with this delay the first cases in each center appeared after a considerable interval,

(*c*) That cholera outbreaks when they did occur were of comparatively short duration, the end coinciding often with the coming of cold weather.

The whole 1926 cholera epidemic probably claimed only 1,500 victims in Manchuria as compared with over 10,000 in 1919; this is specially marked in the case of Harbin which had 4,500 in 1919 and only 280 in 1926. The only severely affected centres were Antung (480), Kirin (320), Harbin (280), Changchun (210), Yingkou (167). Other cities of Manchuria show a corresponding decrease. This satisfactory state of affairs may be traced to :

(*a*) Early preventive measures by the medical administrations.

(*b*) Good understanding between the civil and medical authorities,

(*c*) Hearty co-operation between the Chinese and Japanese health personnel,

(*d*) Effective educational propaganda among the masses who willingly receive prophylactic inoculations and send their patients early to hospital for treatment,

(*e*) Perhaps prevailing wet weather during the second half of the summer.

Turning now to our Harbin experiences, we may class them under three headings, namely :

A. Epidemiological study,

B. Cholera notes from Pinchiang Hospital,

C. Laboratory Reports.

The data gathered are not complete but we hope to supplement these in a later article. It is hoped that each section may contribute something to the knowledge of this disease in China, particularly the ease with which the disease may be bacteriologically diagnosed early in an epidemic, and also the successful result of the hypertonic saline infusion. Lastly the need for detecting early carriers, especially at sea and river ports, seems to us all important. For this reason we support the policy of mass fecal examination adopted in Dairen for passengers and crews of steamers arriving from infected localities.

WU LIEN TEH.

A. EPIDEMIOLOGIC STUDY OF THE CHOLERA EPIDEMIC IN HARBIN 1926.

(To be read with Tables I-XIV).

Mortality figures.

As can be seen from Tables I and II there is a great difference in the mortality observed in our hospital (17.3) and that of the patients admitted in the Municipal Hospital (54.5) while the Railway Hospital takes an intermediate position with 34.5% fatal cases.

A similar discrepancy between our records and those of the Russian hospitals was evident also in the epidemic of 1919 (57.77 and 14.11). This appeared fully accounted for by the differences of therapy used, our favourable results being due to the use of *hypertonic intravenous* salt infusions while the Russian doctors at first stuck to *subcutaneous* administration of *normal* saline. Though, as will be shown later, the question of the therapy employed played probably a role also in the 1926 epidemic. this factor alone cannot account for the differences of mortality observed. In this epidemic hypertonic intravenous infusions were also given in the Municipal and Railway hospitals. Specially the doctors of the former took great pains to ascertain our methods of treatment and to adopt them for their patients.

When analysing the records of the 1926 epidemic we have to consider that possibly a better resistance of Chinese patients against cholera may account for our results. In fact in the Municipal Hospital where both foreigners (mainly Russians with a few others like Jews, Poles, Armenians and one Korean) and Chinese were admitted, the former had a mortality of 57.5%, the latter of 50%. In the Railway Hospital this is still more striking, the figures being 43.5% and 28.1% respectively (see Table I). Since cholera is a rare visitor of North Manchuria and Shantung (which supplies the majority of our coolies) and a natural immunity cannot be expected, allowance must be made for the existence of a stronger resistance among Chinese. However, in our opinion this cannot wholly explain the great difference in the figures for two reasons :

i. The mortality among the Chinese admitted in the two other hospitals is far higher than that in our own (see Table I).

ii. If such a resistance should exist to a marked degree, slight cases ought to preponderate among our patients. This, however, was not the case, the majority of our sick presenting typical symptoms of cholera. Also there is no reason to assume that only the serious cases reached our hospital, a majority of slight ones remaining unnoticed at their homes.

What other factors could then have been at work? In order to elucidate this question it will be well to analyse step by step the figures available.

a. Sex incidence.

Table III shows that in the Municipal Hospital more foreign females were admitted than males (65.0% as against 35.0%). Naturally the thought arises that perhaps a greater mortality among the former might account for the high total mortality. Table IV, however, shows just the contrary. Also in our and the Railway hospitals the mortality of males was perceptibly, though no so markedly, higher than that of females. This table also shows that both in the Municipal and the Railway Hospital the mortality of foreign males was considerably higher than that of the Chinese. This might be explained in part by the better resistance of the latter. Other factors are probably at work as well: these will be discussed later on.

b. Age incidence.

While scanning the records of age incidence (see Tables V & VI) we find no differences worth considering. Both among Chinese and foreigners the incidence of the disease and the mortality are highest in the young adult.

c. Occupation.

A study of the occupational incidence (unfortunately only limited figures are available) does not teach us much (see Table VII a & b). The most striking figures in the Russian table are these recording an outbreak among 12 patients who were in the general hospital and two hospital employees. This will be discussed separately but we may state here that the mortality among the patients was even slightly lower than that of the outside admittances (see Table VIII). The incidence among persons out of work is comparatively high (22.5%—Table VII b). However, here also the mortality is not above the average (about 50%).

d. Time of admission.

A fundamental difference existed in 1926 in regard to the system of admission in Pinchiang on one hand, in the Special Area (Municipal and Railway Hospitals) on the other. In the Special Area the patients were mainly brought compulsorily to the hospital and kept there—if necessary by force—as long as deemed necessary (see Table IX). In Pinchiang we did not even attempt to adopt such a rigid scheme. Our policy was to appeal to the population to seek our aid by all available means (personal urging through our sanitary inspectors, distribution of hand bills, posters, etc. all over the Chinese Town etc.). That our campaign was successful may be gathered from several facts :

i. 76% of 85 patients for which we have exact data, sought admittance during the first two days of illness (see Table X).

ii. A comparatively large number of patients came who suffered not from cholera but from other bowel complaints (see Table

XI). However, they had heard of our successes and—being afraid to run unnecessary risks—availed themselves of our advice and treatment.

iii. Actually we can assert that 90% of the cholera cases in Pin-chiang went through our hands. Certainly they benefited by our treatment, which was given free of charge without any hindrance of the personal liberty to themselves or friends.

Our colleagues of the Municipal Hospital complained that the compulsory system led, not to a speedy dispatch of the cases to the hospital, but to hiding of same and asserted that the delayed admittance of the patients was to a large degree responsible for their unfavourable results. They assert that besides the cases arising in the hospital itself only very few patients were admitted on the first day of illness. A study of Table X shows in fact that the percentage of their first and second days' admissions was less than ours. We do not think, however, that the differences are marked enough to account fully for the discrepancies in the mortality figures. Moreover our figures could be based upon about half of the cases only. Finally the percentage of mortality according to the day of illness (see Table X, last columns) shows in both hospitals such strange oscillations that one must hesitate to draw any final conclusions.

Summarising we may say that the facts so far available do not fully explain the differences in the mortality figures. We proceed now with a discussion of two other factors which are of great importance.

e. Physical status and mode of life of the patients.

Our own patients were mainly of a modest social standing with ample opportunity for exercise through work and in no danger of over-feeding; likewise, alcoholics were very rare among them. Our Russian colleagues assure us that they had a very high percentage of habitual drinkers. During our visits to the Municipal Hospital we could notice such cases as well as specimens of Russians who believe in eating as much as possible, considering floridness as a sign of good health. It is well known that drunkards fall an easy prey to cholera. Likewise it has been our experience in this as in other infectious diseases that it is not the florid and markedly well nourished but the wiry individuals who stand a good chance of overcoming infection. These factors may explain in part the high mortality among foreign males, but they cannot be generally accepted for Chinese (see Table IV d.). Certainly only a part of the latter, if any, adopted the eating and drinking habits of the Russians among whom they lived.

f. The problem of treatment.

Our organisation stands in the first line for the fight against epidemics. Both our staff and our equipment are in constant preparedness for such, so that we can take up the work at short notice. In the Russian Hospital no such ready organisation existed; the wards for infectious diseases

were filled with patients and had to be evacuated under great difficulties to make room for the influx of cholera patients; a new staff had to be organised to take charge of the latter. These difficulties certainly reflected upon the quickness with which treatment was given; as we saw personally, delays were inevitable for some time until a routine was created.

Our patients, who came voluntarily, reached the hospital quickly without having to go through formalities or having to wait for the ambulance, etc. In the hospital we took them at once to the infusion room, if necessary without insisting upon bath, change of clothes, elaborate examination, etc. Likewise everything was ready day and night for the quick repetition of the infusions. We have reason to assume that the procedure in the Municipal Hospital was a longer one.

2. *Cholera outbreak among inmates of the Municipal Hospital.**

An unusual and alarming feature of the 1926 epidemic was an outbreak among inmates and employees of the Municipal Hospital (see Tables VIII & XII).

This solidly built hospital is situated in the Special Area in one of the healthy outlying districts of the town. The Hospital consists of two spacious compounds, separated from one another by a public road. On one side of this street the main building is situated. On the ground floor are accommodated the female wards for (a) internal diseases and (b) gynecological cases, while the upper floor is occupied by the surgical department. The building is up to modern requirements and kept in excellent order; the principal drawbacks are that (a) it is often overfilled with patients and (b) there are no fly screens in the doors or windows. The kitchen for the whole hospital is housed in a separate newly erected building (costing $9,000) situated near the main block. Across the street lies the male ward for internal diseases, which is of wooden construction. Next to this is a spacious isolation block for infectious cases. Lastly comes the newly erected ward for skin and veneral diseases.

From Table XII it can be seen that the outbreak among the hospital inmates began on August 11, while cholera cases had been admitted from outside since August 6 (see Table II). The latter were accommodated in one of the three sections of the isolation block; the two other sections were still occupied by typhoid and dysentery patients. On the first day of the hospital outbreak (Aug. 11) 7 patients and 2 hospital employees (surgical nurse and janitor) fell sick simultaneously; of the seven 3 were surgical patients (2nd floor of main building), 2 were on the ground floor, while the remaining two belonged to the male internal ward and the V.D. department respectively. Two more cases occurred during the night (Aug. 11-12), a third 24 hours later, a fourth on August 14—all among inmates of the main block.

* For information on this as on other points we are much indebted to Dr Bergmann, Chief Surgeon of the Municipal Hospital, and his assistant Dr. Kniazev.

One of the measures devised by the hospital authorities to determine the presence of carriers if any was to examine the stools of all patients accommodated in rooms where cholera victims had been living. This investigation was started on the morning of Aug. 15 and yielded positive results in 6 of a total of 32 contacts (18.7%). Of these, four were in the surgical ward (including a nurse), the other two being respectively in the male and female internal wards. It is an open question whether all the six were healthy carriers in the strict sense, as some of them had had gastro-intestinal disturbances, usually slight diarrhoea. However, others, like the nurse showed no signs of illness whatsoever.

A real cholera case was discovered on the Aug. 17 in a patient confined in the V.D. and skin ward.

There seems little doubt that at least the first eleven out of the fourteen cases contracted infection at one and the same time and probably from a common source.

Unfortunately it was not possible to establish definitely the nature of this source. The first thought would naturally connect the outbreak with a contamination of the water supply; investigation however, ruled this out. The hospital has a deep well which was found in excellent order; the water when examined was free from cholera vibrios. Regarding the food supply the kitchen personnel yielded neither cholera cases nor carriers. No raw vegetables are given to the patients; all milk was boiled. The food was brought to the different wards by the kitchen staff in vessels belonging to the kitchen and distributed by them outside the wards; proper precautions were prescribed to avoid any contamination of the food containers through the crcokery, etc. of the infectious patients. The patients who contracted cholera had various forms of diet; there was nothing which all had in common.

Two theories may be conceived to explain the outbreak :

i. That it might have spread from the cholera patients previously admitted through (a) flies or (b) by intermediate persons (nurses, attendants). The hospital doctors disbelieve this and point out that among the patients suffering from other infectious diseases and still accommodated in the isolation block no cases occurred.

ii. The hospital doctors claimed that the outbreak was due to the bread supply, which came from an outside bakery found to be rather insanitary. It was delivered by a cart hired each day for the purpose and not under the control of the baker. When the bakery was later inspected, one employee was missing and could not be found. The doctors alleged that this man might have had cholera. However, no proof was forthcoming for this. One important revelation was that not all of the victims had bread on their diet list at the time.

After weighing the evidence, we are inclined to dismiss both the fly and the bread theory. When the first cholera cases were admitted into the Municipal Hospital, the personnel were not yet organised for epidemic work. Perhaps, either through inattention or overwork on the part of the nursing staff and lay helpers spread of infection through intermediate contact took place.

WU LIEN TEH,
J. W. H. CHUN,
R. POLLITZER.

TABLE I. TOTAL FIGURES.

Hospital.	Admitted. Chinese	Admitted. Foreigners	Died. Chinese	Died. Foreigners	% Mortality. Chinese	% Mortality. Foreigners
Pinchiang	168	0	29	0	17.3	0.0
Municipal	26	40*	13	23*	50.0	57.5
Railway	32	23	9	10	28.1	43.5
Totals	226	63	51	33	22.6	52.4
	289		84		29.1	

* Including one Korean man.

TABLE II. HOSPITAL ADMISSIONS.

Date		New cases P.H.	New cases M.H.	New cases Rly. H.	Deaths P.H.	Deaths M.H.	Deaths Rly. H.	In Hospital P.H.	In Hospital M.H.	In Hospital Rly. H.
July	20		1						1	
	20-26								1	
	26					1			0	
Aug.	6	4	1	0	1	0	0	3	1	0
	7	2	1	0	1	0	0	2	2	0
	8	2	1	0	1	2	0	2	1	0
	9	1	1	0	0	0	0	2	2	0
	10	2	1	0	0	1	0	4	2	0
	11	2	9	4	0	3	0	4	8	4
	12	2	3	1	0	3	0	4	8	5
	13	6	2	1	0	1	0	11	9	6
	14	2	2	0	0	0	0	10	11	6
	15	3	2	2	1	0	0	9	13	8
	16	4	0	4	0	0	3	9	13	9
	17	8	1	6	1	3	3	13	11	12
	18	10	2	2	1	1	1	20	12	7
	19	8	4	0	1	1	0	24	15	7
	20	11	5	0	0	1	0	25	19	7
	21	20	2	3	2	2	0	22	19	10
	22	7	3	3	5	0	1	25	17	12
	23	7	3	2	1	3	0	29	17	14
	24	8	2	1	1	0	0	29	19	15

Date		New cases P.H.	New cases M.H.	New cases Rly. H.	Deaths P.H.	Deaths M.H.	Deaths Rly. H.	In Hospital P.H.	In Hospital M.H.	In Hospital Rly. H.
Aug.	25	10	0	0	2	0	0	22	16	13
	26	7	2	0	0	0	0	23	17	13
	27	3	0	0	1	0	1	22	18	12
	28	5	1	2	0	1	1	25	18	13
	29	7	0	2	1	1	0	21	17	14
	30	4	3	3	0	5	2	22	15	14
	31	3	2	3	1	0	2	26	17	15
Sept.	1	3	0	1	2	0	0	28	17	15
	2	1	0	5	2	0	2	22	16	17
	3	4	0	0	1	0	0	14	16	16
	4	1	0	4	0	0	0	13	16	20
	5	1	1	0	0	1	1	12	16	18
	6	1	1	1	0	1	0	12	16	18
	7	3	0	1	0	0	0	13	16	15
	8	2	1	0	1	0	1	7	17	14
	9	2	1	0	1	0	0	7	17	13
	10	1	1	0	1	0	0	4	9	13
	11	0	1	0	0	0	0	2	10	11
	12	1	0	0	0	0	0	2	10	11
	13	0	1	1	0	1	0	1	10	10
	14	0	0	0	0	0	0	0	10	9
	15		0	0		1	0		9	8
	16		1	1		0	0		10	9
	17		2	1		0	0		9	9
	18		0	0		0	1		9	8
	19		0	0		1	0		7	8
	20		0	1		1	0		6	6
	21		0	0		0	0		6	6
	22		1	0		0	0		1	6
	23		0	0		0	0		1	4
	24		0	0		0	0		1	4
	25		0	0		1	0		0	4
	26		1	0		0	0		1	4
		168	66	55	29	36	19			

Percentage Mortality :
Pinchiang H. 17.3
Municip. H. 54.5
Railway H. 34.5

Table III. Sex Incidence.

Hospital	Chinese Male No.	Chinese Male %	Chinese Female No.	Chinese Female %	Foreigners Male No.	Foreigners Male %	Foreigners Female No.	Foreigners Female %	Total Male No.	Total Male %	Total Female No.	Total Female %
Pinchiang	135	80.3	33	19.7	0	0.0	0	0.0	135	80.3	33	19.7
Municipal	26	100.0	0	0.0	14	35.0	26	65.0	40	60.6	26	39.4
Railway	31	100.0	0	0.0	16	72.7	6	27.3	47	*88.7	6	*11.3
Total	192	85.3	33	14.7	30	48.4	32	51.6	222	77.4	65	22.6

* Sex of two children unknown.

TABLE IV MORTALITY INCIDENCE AS TO SEX.

(*a*) *Pinchiang Hospital* :

		Per cent.
Male	25	86.2
Female	4	13.8
	29	100.0

(*b*) *Municipal Hospital* :

		%			%			%
Chinese Male	13	100.0	Foreign Male	10	43.5	Total Male	23	63.9
,, Female	0	0.0	,, Female	13	56.5	,, Female	13	36.1
	13	100.0		23	100.0		36	100.0

(*c*) *Railway Hospital* :

		%			%			%
Chinese Male	9	100.0	Foreign Male	7	77.8	Total Male	16	88.9
,, Female	0	0.0	,, Female	2	22.2	,, Female	2	11.1
	9	100.0		9	100.0		18	100.0

(*d*) % *Mortality in Male and Females separately* :

Hospital	Chin. Male	Chin. Female	Foreign Male	Foreign Female
Pingchiang	18.5	12.1	0.0	0.0
Municipal	50.0	0.0	71.4	50.0
Railway	28.1	0.0	43.7	33.3

TABLE V. AGE INCIDENCE.

	Pinchiang Hosp.		*Municipal Hospital*					
	Chinese		*Chinese*		*Foreigners*		*Total*	
Age	Number	Per cent.	Number	Per cent.	Number	Per cent.	Number	Per cent.
0— 5	4	2.3	0	0.0	0	0.0	0	0.0
5—10	5	3.0	0	0.0	0	0.0	0	0.0
10—15	3	1.7	0	0.0	1	2.5	1	1.5
15—20	15	8.8	0	0.0	0	0.0	0	0.0
20—25	23	13.7	3	11.5	5	12.5	8	12.0
25—30	27	16.0	6	23.0	6	15.0	12	18.0
30—35	17	10.1	3	11.5	7	17.5	10	15.0
35—40	20	11.8	6	23.0	1	2.5	7	10.5
40—45	20	11.8	5	19.2	6	15.0	11	16.5
45—50	14	8.3	0	0.0	4	10.0	4	6.0
50—55	6	3.4	2	7.7	3	7.5	5	7.5
55—60	8	4.6	0	0.0	0	0.0	0	0.0
60—65	5	3.0	0	0.0	2	5.0	2	3.0
65—70	1	0.5	0	0.0	3	7.5	3	4.5
70—75	0	0.0	0	0.0	1	2.5	1	1.5
?	0	0.0	1	3.8	1	2.5	2	3.0
Total	168	99.0	26	99.7	40	100.0	66	99.0

Table VI. Age of Mortality Cases.

	Pinchiang Hosp.		Municipal Hospital					
			Chinese		Foreign		Total	
Age	Number	Per cent.	Number	Per cent.	Number	Per cent.	Number	Per cent.
0— 5	1	3.4	0	0.0	0	0.0	0	0.0
5—10	0	0.0	0	0.0	0	0.0	0	0.0
10—15	0	0.0	0	0.0	1.	4.3	1	2.8
15—20	0	0.0	0	0.0	0	0.0	0	0.0
20—25	5	17.0	1	7.7	3	13.0	4	11.1
25—30	3	10.2	2	15.4	4	17.4	6	16.6
30—35	3	10.2	2	15.4	2	8.7	4	11.1
35—40	3	10.2	5	38.5	1	4.3	6	16.6
40—45	3	10.2	2	15.4	3	13.0	5	13.9
45—50	5	17.0	0	0.0	2	8.7	2	5.5
50—55	0	0.0	0	0.0	2	8.7	2	5.5
55—60	4	13.6	0	0.0	0	0.0	0	0.0
60—65	2	6.8	0	0.0	1	4.3	1	2.8
65—70	0	0.0	0	0.0	3	13.0	3	8.3
?	0	0.0	1	7.7	1	4.3	2	5.5
	29	98.6	13	100.0	23	99.7	36	99.7

Table VII. Occupation.

(*a*) *Pinchiang Hospital :*

		Per cent.
Coolie	28	16.6
No occupation	27	16.0
House wife	27	16.0
Small Merchant	16	9.5
Servant	9	5.3
Carpenter	9	5.3
Rickshawman	8	4.7
Mechanic	6	3.5
Shoemaker	6	3.5
Blacksmith	6	3.5
Soldier	5	3.0
Tailor	5	3.0
Mason	4	2.3
Printer	3	1.7
Student	2	1.2
Prostitute	2	1.2
Cook	1	0.5
Bookseller	1	0.5
Washerman	1	0.5
Policeman	1	0.5
Coachman	1	0.5
	168	98.80

(*b*) *Municipal Hospital* :

	Chin. Male No	%	*Foreign* No.	*Male.* %	*Foreign* No.	*Fem.* %	*Total* No.	%
Out of work	2	7.7	5	35.5	8	30.4	15	22.5
Patients	0	0.0	2	14.2	10	38.0	12	18.0
Unknown	5	19.2	3	21.3	1	3.8	9	13.5
Housewife ....:	0	0.0	0	0.0	5	19.0	5	7.5
Coolie	3	11.5	0	0.0	0	0.0	3	4.5
Police	3	11.5	0	0.0	0	0.0	3	4.5
Cook	2	7.7	0	0.0	0	0.0	2	3.0
Merchant	2	7.7	0	0.0	0	0.0	2	3.0
Prison guard	1	3.8	0	0.0	0	0.0	1	1.5
Hosp. Nurse	0	0.0	0	0.0	1	3.8	1	1.5
,, janitor	0	0.0	1	7.1	0	0.0	1	1.5
Contractor	1	3.8	0	0.0	0	0.0	1	1.5
Carpenter	1	3.8	0	0.0	0	0.0	1	1.5
Servant	1	3.8	0	0.0	0	0.0	1	1.5
Midwife	0	0.0	0	0.0	1	3.8	1	1.5
Private guard	1	3.8	0	0.0	0	0.0	1	1.5
Janitor	1	3.8	0	0.0	0	0.0	1	1.5
Cleaner	1	3.8	0	0.0	0	0.0	1	1.5
Old cl. merch	1	3.8	0	0.0	0	0.0	1	1.5
Tailor	0	0.0	1	7.1	0	0.0	1	1.5
Sailor	0	0.0	1	7.1	0	0.0	1	1.5
Gardener	1	3.8	0	0.0	0	0.0	1	1.5
Teacher	0	0.0	1	7.1	0	0.0	1	1.5
Totals	26	98.5	14	99.4	26	98.8	66	99.0

TABLE VIII.

Municipal Hospital :

	Total	*Died*	*% Mortality*
Admitted from hospital	12	6	50.0
,, ,, outside	52	28	53.8
	64	34	53.1

N.B.—The nurse and the door-keeper who worked in the Hospital but lived outside were not counted.

Table IX. Duration of stay in hospital.

Days.	*Pinchiang Hospital.* No.	%	*Municipal Hospital.* No.	%
1	22	13.0	13	19.9
2	35	20.8	7	10.7
3	28	16.6	4	6.1
4	23	13.7	2	3.1
5	22	13.0	3	4.6
6	15	8.8	5	7.7
7	6	3.5	2	3.1
8	6	3.5	2	3.1
9	6	3.5	2	3.1
10	2	1.2	2	3.1
11	0	0.0	4	6.1
12	1	0.5	1	1.5
13	1	0.5	3	4.6
14	0	0.0	0	0.0
15	1	0.5	1	1.5
16			2	3.1
17-19			0	0.0
20			1	1.5
21			2	3.1
22			3	4.6
23			1	1.5
24-25			0	0.0
26			3	4.6
27			1	1.5
28			1	1.5
	168	99.1	65	99.6

Table X. Fate of patients according to the day they were admitted.

	Pinchiang Hosp. *Admitted* No.	%	*Recov.*	*Died* No.	%	*Municipal Hosp.* *Admitted* No.	%	*Recov.*	*Died* No.	%
Day of illness										
1st	32	37.4	27	5	15.6	16	24.2	7	9	56.3
2nd	33	38.6	25	8	24.2	19	28.7	11	8	42.1
3rd	11	12.9	9	2	18.1	11	16.6	4	7	63.6
4th	7	8.2	5	2	28.5	8	12.1	4	4	50.0
5th	1	1.2	1	0	0.0	8	12.1	3	5	62.5
6th	0	0.0	0	0	0.0	4	6.0	1	3	75.0
7th	1	1.2	1	0	0.0					
	85	99.8	68	17	20.0	66	99.7	30	36	54.5

TABLE XI. DIFFERENTIAL DIAGNOSIS (PINCHIANG HOSPITAL).

Acute alcoholism	1
Gastro-enteritis	4
Diarrhoea	32
Dysentery	5
	42

TABLE XII. DETAILS OF MUNICIPAL HOSPITAL OUTBREAK.

No.	Sex	Age	How long in hosp.	Ward:	Illness:	Diet:	Date attkd by chol.:	Result:
1	F.	31	July 29	Surgic.	Appendic.	Common	Aug. 11	Died Aug. 12
2	M.	67	Aug. 2	Male's Intern.	Chron. gastr.	Weak	,, 11	Died ,, 11
3	F.	12	,, 3	Surgic.	Appendic.	,,	,, 11	Died ,, 12
4	F.	28	June 19	V. D.	Lues	Common	,, 11	Died ,, 17
5	F.	70	Aug. 7	Women's Intern.	Pleuritis	Milk	,, 11	Died ,, 13
6	F.	53	May 25	Surgic.	Ventral hernia	Common	,, 11	Recov.
7	F.	34	July 6	Women's Intern.	Morbus cordis	Milk	,, 11	Recov.
8	F.	34	,, 22	—"—	Pyelitis	Vegetable	,, 11—12	Recov.
9	M.	34	Apr. 13	Surgic.	Tbc. & Amyloid	Common	,, 11—12	Died Aug. 12
10	F.	43	Aug. 8	Gynecol.	Pelveoperiton.	Strict	,, 12—13	Recov.
11	F.	72	July 28	Surgic.	Fracture, femur	Common	,, 14	Recov.
12	F.	61	Aug. 6	V. D.	Eczema helminth.	—"—	,, 17	Recov.
13	F.	40		*Nurse,* Surgic.			,, 11	Died Aug. 11
14	M.	30		*Janitor,* Main Bldg.			,, 11	Died ,, 17

Remarks : *Diets.* Common—ordinary diet for convalescents.
Weak—milk, jelly, toast, bouillon, eggs.
Milk—milk, dishes made with milk, toast or bread.
Vegetable—vegetable soup, milk, toast.
Strict—milk, bouillon.
The employees had common diet while on duty.

Table XIII. Died at which day of illness.

Day of illness :	*Pinchiang Hospital.* No.	%	*Municipal Hospital.* No.	%
1st	5	17.0	14	43.75
2nd	7	23.8	6	18.75
3rd	3	10.2	4	12.50
4th	3	10.2	2	6.25
5th	3	10.2	6	18.75
6th	2	6.8		
7th	3	10.2		
8th	0	0.0		
9th	1	3.4		
10th	0	0.0		
11th	1	3.4		
12th	0	0.0		
13th	0	0.0		
14th	1	3.4		
	29	98.6	32	100.00

Table XIV. Showing Instances of Successive Cholera Cases from the same Address.

	Address.	*Name.*	*Sex.*	*Age.*	*Date of admission.*
a.	Orphanage in 19th street	Sung	M	6	Aug. 10
		Tsia	M	8	,, 11
		Hsu	M	16	,, 12
		Li	M	14	,, 13
		Liu	M	14	,, 14
		Chang	M	50	,, 15
		Chen	M	57	,, 18
		Wang	M	60	,, 18
		Si	M	46	,, 18
		Liu	M	65	,, 20
		Chao	M	38	,, 21
		Chang	M	44	,, 21
		Chang	M	32	,, 21
		Chang	M	67	,, 21
b.	Railway guard barracks	Chiao	M	42	Sept. 26
		Shu	M	31	,, 29
		Chao	M	32	,, 30
		Kuo	M	26	,, 30
		Lu	M	24	,, 4
c.	12th street, behind park	Tang	F	5	Aug. 14
		Tang	F	6 (sister)	,, 21

d. Harbin Municipal Hospital. See Table XII.

B. CHOLERA NOTES FROM PINCHIANG HOSPITAL 1926.

INTRODUCTION.

Since the epidemic of cholera in 1919 when 4,500 deaths were reported in Harbin, we have been free from the visitation of this "tigerish" disease, though we heard of the occurrence of yearly cholera outbreaks in Shanghai.

This year cholera made its appearance in May in Shanghai and rapidly assumed a severe form due in part to the exceedingly hot summer. The port was accordingly declared infected and quarantine measures were instituted at different sea ports against it, including Tsingtao, Dairen, Newchwang and Antung. In spite of all this, the infection was brought right through South Manchuria by carriers and the first recognized cases were seen at our hospital on August 5.

The beginning of the summer was exceedingly hot and dry; flies were in evidence in unusually large number, reminding us of the cholera year of 1919. We were fully prepared, therefore, against the invasion, having gained experience and proceeded to profit by it. Our hospital and staff have increased in equipment and personnel. Everything and everybody were ready to cope with any emergency.

A very large percentage of the patients (estimated at 90%) came of their accord and at an early stage of the disease for treatment, showing that the people of the city have heard of and have faith in our effective methods for dealing with this disease. Almost all of them were brought by one or more of their friends and relatives. Seventy-six per cent of them came to the hospital on the first or second day of illness, a large number of them having been acupunctured by native doctors in the basilic vein in one or both elbows. Though they were mostly brought by friends, our sanitary inspectors stationed at the four wards of the Chinese city have not been idle. At the time of epidemic, their special attention was directed to the detection of cholera patients and their hospitalisation, and it was partly due to their efforts that such a large proportion of the affected came. Looking at the map of the city, which we marked with little plugs to show the particular spot from which each patient was hailed, one would be struck with the uniform scattering of the flags. They seemed to be almost evenly distributed throughout the whole city. Out of 168 true cholera cases, 30 came from the Railway Area, however.

ADMISSION ROUTINE.

As soon as the patient was brought inside the compound, his friends were interrogated by the clerk as to particulars with regard to the name,

age, occupation, day of illness and address. Meanwhile the doctor in charge examined the patient in the open air and determined whether the patient was suffering from cholera or not. If infusion was considered necessary, he was at once carried into the infusion room where eight patients could be injected at the same time. The doctor or dresser in charge gave the injection while another dresser sat by the patient and kept watch to see that the arm did not move and that the saline was running in properly. After infusion was completed the patient was carried to block No. 1 where new cases were admitted. A label with a number was tied to the wrist for identification; his name and number were put on the door of the room. When block No. 1 was full, the older cases were transferred to block No. 2.

The criterion for the need for infusion was the pulse. If it was small or impalpable, then saline was indicated. On the other hand, if it was good, and the general appearance of the patient warranted, only kaolin water was given and the patient put in a cubicle in block No. 1. Often it was possible to make a correct diagnosis at a glance, but if there was any doubt, the patient was made to pass a stool in an earthenware bowl and the stool was examined by the bacteriologist. The important point is that no time was wasted in unnecessary formality. As soon as the patient arrived, he was given attention. This aspect deserves special mention, because the time element is very important and delay may turn the scale against the chances of recovery.

We found it sufficient in dealing with this epidemic to maintain two doctors on day duty and one at night. Three shifts of dressers were arranged for the 24 hours at 8 hours each, so that patients were attended to at all times of the day and night. We also had two shifts of day and night attendants. In this way new cases were promptly treated, and old cases were watched all the time. If their conditions demanded, a second and a third injection could be given, or other auxiliary therapeutic measures administered. We prepared hypertonic saline solution in 1000 c.c. flasks and kept them warm all the time in a large water tank heated with firewood in a room in the compound. In this way, warm sterilized saline could be had at any time of the day or night.

A small temporary laboratory was fitted up near the wards where the examination of urine and other simple tests could be carried out. The stools were examined and cultivated in the big laboratory in another compound.

CLINICAL PICTURE.

All particulars of the patients, such as age, occupation, sex, etc., are embodied in the form of tables. Suffice it to say that all the patients were of Chinese nationality; 80.3% were males, the rest (19.7%) were females, as against 92.8% males and 7.2% females in 1919; as before young adults between 25-30 years of age formed the highest percentage of patients; coolies, persons of no occupation and housewives were among the commonest of the patients; most of them stayed from one to five days.

Out of 168 admissions, 29 died, a mortality of 17.2%. Among these 29 deaths, 25 (86.2%) were males and 4 (13.8%) were females. The highest mortality was shared equally between those at ages 20-25 and 45-50 (17%). The largest number of patients died on the second day of illness (23%), showing the collapse stage was the most dangerous. After the 7th day of illness, the chances of recovery were good, for very few died if they could survive up to this period. The chief cause of death may be said to be collapse; some severe cases or cases weakened in any way by previous conditions died inspite of every effort to save them. The second danger was uraemia, the third heart failure, the fourth toxaemia and the fifth pneumonia. We had two cases with delirium, one on the second day of illness and the other on the 5th day. The prognosis for these cases seemed very bad. The latter, a young strong man, died in the hospital, and at post-mortem his organs showed signs of chronic alcoholism.

Reviewing the cases, we may say on the whole they were on the light side. Suppression of urine caused anxiety in some cases, while albuminuria was very frequent. A few died of uraemia, notably an old man of 63, who stayed in the hospital for 14 days. His urine showed much albumen and acetone. On the 4th day of stay, he developed coma which was successfully treated by venesection, 300 c.c. blood being withdrawn. He gradually improved under protoclysis with normal saline, but died of hypostatic pneumonia.

Now a word about toxaemia. Patients almost always showed a reactionary fever after infusion, the rectal temperature being the best guide. But when the purging stopped either naturally or as the result of the hypertonic infusion, absorption of cholera toxin from the intestines caused a rise of temperature, often 103° F. was registered. Two cases showed severe signs of toxaemia. one a strong young man of 31, who was treated on the first day of illness with infusion. On the 2nd day he seemed better. On the 4th day, however. he showed high fever. was unconscious. and a well marked septic rash appeared on his trunk and thighs; death occurred on the next day. The other was a smallish man of 27, who was injected twice, 3000 c.c. being given on the first day and 2000 c.c. on the second day. It was seen also that he suffered from a tertiary syphilide. On the seventh day, he developed fever and hiccough. His urine was repeatedly examined, only a trace of albumen was found and no acetone. A marked septic rash appeared all over his body. Though his condition was critical, he gradually improved and left the hospital on the 14th day.

Acidosis was often met with as indicated by the presence of acetone in the urine. For the treatment of this condition, Sir Leonard Rogers advocated the routine administration of large doses of sodium bicarbonate (gr. 160 to a pint of normal saline), one pint being injected intravenously just before the hypertonic saline infusion. Owing to the difficulty of sterilizing the bicarbonate, because heat changes the bicarbonate to carbonate which causes necrosis to the tissues unless the solution is injected straight into the vein, we have not adopted his method, but relied on the administration of large doses of sodium bicarbonate by the mouth.

The typical text-book picture of a cholera patient need not be described here. The severe or moderately severe cases can be easily recognized. The incipient or light cases have to be admitted and watched. Their physical condition and their stool must be examined. Not all of them voided the typical rice water stool, for again and again the bacteriologist was able to isolate the vibrio cholerae from light yellow stools, or bile-stained or even blood-stained stools. The final diagnosis rested with the isolation of the vibrio and the agglutination by specific serum.

Mention may be made shortly of the different other diseases which we had to diagnose, viz. drunkenness, gastro-enteritis, summer diarrhoea, dysenteries, typhoid and paratyphoid. In case of doubt and before a definite diagnosis could be made, we administered the hypertonic saline infusion, if the physical condition, the pulse and the blood pressure of the patient demanded it.

TREATMENT.

Prophylaxis. Warning was given to the public in the form of bulletins and newspaper articles against cholera. Personal prophylaxis in the form of anti-cholera inoculations was advocated and practised. The means of spread of the disease was carefully explained and blame was put on flies, soiled fruits, vegetables and uncooked food. The police helped by the prohibition of the sale of melons which was then in season.

In order to protect our staff against cholera, they were inoculated with the anti-cholera vaccine which was manufactured in our own laboratory. Before they entered the cholera ward, overalls were donned, and rubber goloshes were put over their shoes. On emerging, they rubbed the soles of the goloshes on door-mats soaked in izal fluid which were placed in front of the doors. The hands were soaked in a basin of the disinfectant placed outside the wards. They were instructed to wash their hands very carefully before taking food. When they had to soil their hands in the course of their work, they wore rubber gloves. That these and other precautions were efficient was shown by the fact that none of our staff got infected.

For the accommodation of the cholera patients, plain wooden beds were used, with no mattress. By the bed-side an earthenware basin containing a little disinfectant fluid was placed to receive the vomitus, stools and urine. Flies were excluded by window and door screens. Fly powder and fly paper were also freely used. The stools were emptied into barrels containing disinfectant and they in turn were emptied into a covered pit as they became full.

The food of the patients consisted only of congee (rice broth). As they improved, gradually other items were added, such as soup, biscuits and plain Chinese cakes. Great difficulty was experienced in combatting the natural craving for more food and the smuggling of unsuitable eatables by friends.

Therapeutic measures. We relied mainly on the hypertonic saline intravenous infusions as a means to restore salts and fluid in the system. Often the patient recovered immediately and it would appear as if snatched from the grave. In the collapse stage there does not appear to be any thing superior. We used the ordinary douche can and a six feet rubber tubing. A 1 c.c. syringe barrel was fitted to the other end of the tube to which an intravenous needle, as large as convenient, was attached. The basilic vein at the elbow was usually selected and made to stand out by constriction of the arm; the skin was cleansed with spirit and the needle plunged into the vein. If blood flowed into the glass barrel, then the saline was allowed to run. Usually 1500 c.c. to 3000 c.c. were injected at one time and as rapidly as possible. Generally the injection was completed in half an hour. The saline was given at about 104°F. in the douche can. The condition of the patient was watched. If the pulse was full and bounding or if the shivering or restlessness was excessive, the injection was stopped.

Some patients required one injection; most patients required two, not necessarily on the same day; some required three or more; while others could not be saved by any means. If the vein could not be entered, we dissected it out and injected by the open method or the saline was given subcutaneously. Coming to auxiliary measures, mention must be made of kaolin. For light cases and also for moderately severe cases after infusion, we gave a bowlful at a time every two hours; in all, if possible, six bowlfuls were given. The kaolin was suspended in water, 100 grammes in 250 c.c. We found some of the patients could not tolerate it well, because they almost always vomited, directly they swallowed it into the stomach.

Similarly, weak potassium permanganate solution, 1 in 2000, was freely given, but it was not liked by some of the patients.

For the failing heart we used hypodermic injections of digitalin, camphor and adrenaline. These auxiliary measures were highly useful, when one considers the real cause of the collapse. It is true that the withdrawal of fluid and salts from the system plays a great part, yet the cholera toxin exerts a very great influence in the production of the well known clinical picture, namely, sunken eyes, anxious facies, cold extremities, hoarse voice, cramps, and weakened heart. Both kaolin and permanganate tend to neutralize the toxin manufactured by the cholera vibrio in the intestines. We consider them therefore exceedingly useful adjuvants. We have not used any anticholera serum, and so cannot express any opinion on its merits.

For acidosis, we used large doses of sodium bicarbonate per so as already stated.

For the treatment of uraemia, we believe in subcutaneous injections of physiological saline, or proctoclysis together with cardiac stimulants. If coma supervened, we employed venesection.

B. Cholera Notes from Pinchiang Hospital 1926.

Cholera is a disease which has tigerish characteristics, as the Chinese consider it. It attacks suddenly, but it also leaves the patient well quickly. In treating this disease, the physician demonstrates exceedingly clearly the great principle of medicine, namely to assist nature and not harm the patient. For instance he must not check the purging by the administration of opium, rather he must replenish the lost fluid and salts, neutralize the toxin, stimulate the heart and treat each complication as it makes its appearance. Given a fair chance, nature will do the rest, if the attack is not overwhelming and the patient is not weakened by previous illness, or indulgence. The physician, on his part, must act quickly, observe closely and be ready to meet all emergencies, exemplifying the qualities of which Henley wrote :

> Faultless patience and unyielding will,
> Beautiful gentleness and splendid skill.

Formula of Hypertonic Saline Solution.

Sodium Chloride	gr.	120	(8 grammes).
Calcium Chloride	gr.	4	(0.25 ,,).
Potassium Chloride	gr.	6	(0.40 ,,).
Distilled water	pint	1	(568 c.c.).

J. W. H. Chun, M.B., (*Cantab*),
(*Senior Med. Off. Harbin*).

C. LABORATORY REPORTS.

Introduction.

In view of the fact that in some parts of China no advantage is taken of bacteriological methods for the diagnosis and control of cholera epidemics, it may be well to give some hints as to the simple means we used in our work. We performed this usually with two media only, peptone solution and ordinary nutrient agar of alkaline reaction. The use of special media, in the first line of Dieudonné Agar (3% neutral agar mixed with defibrinated and alkalised cattle blood in a proportion of 7:3) is very advantageous but can be dispensed with for routine work; we used this—apart from scientific investigations—only in special cases.

We prepared peptone solution according to the formula contained in the German "Anweisung zur Bekaempfung der Cholera"(1):

Take Peptonum siccum Witte	100,0	gram
Sodium chloride	100,0	,,
Sodium nitrate	1,0	,,
Cryst. Sodium carbon.	2,0	,,
Sterile distilled water	1000,0	c.c.

Mix solids with water and dissolve by heating. Then filter (if necessary twice through same paper), fill in flasks of 100 c.c. and sterilise in the autoclave.

When peptone solution is wanted, one part of this stock solution is mixed with 9 parts of sterile destilled water, filtered if necessary, filled in small flasks or test tubes as wanted. Sterilise in the autoclave.

Technic of stool examination.

From the material (a) films and (b) cultures in peptone solution are made. In early suspicious cases 1-3 flasks containing 50 c.c. of the solution are used; during an epidemic it is sufficient to use test tubes containing 10 c.c. of the medium if small quantities of the feces are taken, a mucous floccule being picked out if present.

(a) The films are stained with freshly diluted carbol fuchsin (1 : 10). Sometimes it is impossible to come to a *prima-facie* diagnosis by inspections of the films. On one hand, as was our experience in the 1926 epidemic, only a few characteristic vibrios may be present in addition to other bacteria, though good cholera cultures are easily obtained from

(1) Quoted by Klimmer, Technik and Methodik der Bakteriologie and Serologie, Berlin, 1923, p. 8 and following.

such material; on the other in many non-choleraic stools forms resembling the *Vibrio cholerae* may be seen which may prove misleading if caution is not used. At the best not more than a suspicion of cholera can be reached by inspection of smears.

(b) The inoculated flasks or tubes are incubated for 3-5 hours; in early cases it is well to examine them both after 3 and 5 hours; during an epidemic and in cases with typical stools we can with safety proceed after 3 hours.

No reliance should be placed upon the mere appearance of peptone cultures. It is often maintained that—if cholera vibrios are present—the cultures become—owing to the rapid growth of this kind—cloudy after 3 hours incubation, whilst clearness of the fluid practically excludes cholera. In this epidemic we have seen instances of cloudiness after three hours in spite of the absence of cholera vibrios; on the other hand the cultures may be almost or even quite clear after five hours, though good growths of cholera bacilli are obtained from them; the latter category of cases is rare.

The methods chosen for examination and further treatment of the peptone cultures vary according as to whether (i) no great dispatch is necessary (clinically typical cases during an epidemic, contacts, etc.) or (ii) a speedy diagnosis is wanted (early, atypical cases, etc.).

(i) In the first case it is sufficient to take with the platinum needle one drop from the upmost part of the peptone culture (gently tilting the vessel if a membrane has formed on the surface to avoid touching this) and to place this drop on an agar dish. This is then spread out with the aid of a sterile glass spatula and a second dish inoculated with the same spatula. After 12 hours good growth will be obtained. Cholera colonies show, when inspected from above, a grayish-white colour, whilst in transparent light they assume a distinct bluish lustre. This is well seen when standing not quite near but at some distance from the window and enables one to detect colonies from which smears are to be made. When cholera-like bacilli are seen, such colonies may either be directly transplated on agar slants or they may be passed through peptone water and then on slants. The last method is more certain to give a pure culture for agglutination tests.

(ii) The procedure to be chosen when dispatch is necessary, depends upon an inspection of films taken from the topmost part of the peptone cultures. If vibrios are found in pure culture, then it may be possible to proceed directly with agglutination tests. Often this will not be the case; then two methods have to be applied:

1. New peptone flasks or tubes are inoculated under the precautions described above (after 3 and 5 hours incubation). This may still be repeated one or several times at 3 hours' interval until a pure culture of vibrios is obtained.

2. Agar dishes are inoculated after 3 and 5 hours incubation from the original peptone cultures or from one of the subcultures where a fair number of vibrios is seen.

If cholera is present, it will usually be possible to obtain a pure culture after 3-18 hours.

The technique of the agglutination tests is described in all text books on bacteriology and serology. Either the microscopic or macroscopic methods may be chosen. It is necessary to make controls with a proved cholera strain and with suspensions of both this and the bacteria to be tested in physiological salt solution to watch for any tendency to sedimentate spontaneously. If quick results are desired and a peptone culture showing pure or almost pure growth of vibrios has been obtained, a good preliminary test may be made by simply adding with a capillary pipette one drop of the agglutinating serum. This corresponds to a dilution of 1 :200 to 1 :500 and the positive result (which is seen within half an hour) establishes strong *prima-facie* evidence. By this method it is sometimes possible to come to a decision within four hours(2).

At the height of a bacteriologically established epidemic it may not be necessary to test each strain by agglutination. If only few workers are available bacteriological examination for every case may not be necessary since the time is better spent upon more urgent tasks, such as preparation of vaccine, examination for carriers, of water, etc. But bacteriological and serological tests are essential in non-typical cases.

A few words may be devoted to the mass examination of feces for detection of carriers needed sometimes for maritime or railway quarantine work. In this connection the method adopted by the Japanese authorities at Dairen may be recommended.

This consists, in the case of steamers arriving in port, of :

1. Enforced defecation by all members of crew and passengers on the morning of arrival and collection of small samples in little Petri dishes.

2. Placing of a small particle of specimen with sterile toothpick in test tube containing peptone water.

3. Handing over of all the peptone cultures (4-6 hours old) in racks of thirty tubes each to the quarantine authorities.

4. Making of films (five on one slide), drying over a spirit lamp, staining with dilute carbol fuchsin for ½ min., drying between filter paper without washing in water, then examining under the microscope(3).

(2) If agglutinating serum cannot be prepared at the spot, it is easily procured from one of the serological institutes in China.

After this introduction we can discuss the findings made in the past epidemic.

I. Results of stool examination.

(*a*) Patients. It is essential for the laboratory workers to be always in close touch with the clinicians so as not to interpret negative findings wrongly. Owing to the presence of many other microorganisms in the feces or to other untoward circumstances, it may happen that no cholera growths are obtained. If the case is clinically suspicious, new stool samples must be procured and only after two or three examinations are proved negative can the patient be declared cholera-free though clinically suspicious. We saw a few such instances where the first examination was negative, but the second positive.

Only in twenty-five per cent of the positive cases the stools were typical, rice-water-like. In the rest they were liquid, often with mucus, and more or less stained. In one instance (Pt. 199) the stool was of a more pasty consistence and showed many gas bubbles. Patients 29 and 201 voided pinkish but otherwise typical stools. Patient 186 had distinct admixture of blood in the stools; the findings in his case were as follows :

Sept. 3 : Stool consists of a watery pink liquid in which white and reddish floccules are suspended. Cultures show growth of somewhat atypically shaped vibriones; agglutination positive.

Sept. 4 : Stool as yesterday; in unstained specimens red blood corpuscles and many leucocytes were seen but no amoebae. Cultures negative for cholera.

Sept. 5 : Typical, rice-water-like stool, containing no blood. Culturally, cholera positive.

Presumably the admixture of blood in these cases was due to some preexisting process (internal haemorrhoidal nodes, etc.).

(*b*) *Personnel.* No positive findings were obtained. This is not surprising as all precautions, including vaccination, were taken.

(*c*) *Contacts.* Among the relatives or friends of the patients positive findings proved by agglutination were obtained in 2 out of 43 cases, i.e. in 5%. Probably the percentage would have been greater, if the stool of each contact had been examined not once but repeatedly; this, however, was only rarely possible. The following data are given regarding the two "carriers".

---

(3) In this way, Dr. Yano of the Naval Quarantine Service could with the aid of another trained doctor assistant inspect six slides, that is 30 specimens, in one minute. While I was in the Laboratory the examination of 280 specimens took just 40 minutes from the time of arrival of the peptone cultures to the final report by telephone to the shipping authorities. In addition to Dr. Yano, there were two medical assistants and six technicians in August 1926 undertaking these fecal examinations for steamers arriving from Shanghai.—(Ed.)

Case A was a strong young man, contact to our No. 61 cholera case, admitted Aug. 18, died Aug. 21. From this contact on Aug. 20 a sample of liquid brown stool was obtained. Smears showed only a few suspicious forms, but a pure culture of vibrios, giving a positive agglutination test, was easily obtained. When seen on Aug. 21, the man declared himself to be quite well; he was just eating raw apples! Normal pulse and temperature. He said that he had slight diarrhoea a few days ago, but only one stool each of the last two days. On the 22nd and 23rd he continued well, but had two liquid stools daily. Then he swallowed of his own accord opium in order to cure himself. A swab taken on the 23rd still gave a positive result. On the 24th the stool was of normal consistence, brown in colour. Suspicious forms were seen in films and positive cultures were obtained.

This was probably a light ambulant case and not a carrier in the strict sense.

Case B, in contact to patient No. 73 (admitted on August 20) had on Aug. 23 a pasty, almost liquid stool, yellow in colour, resembling that of a healthy infant. A pure culture, showing positive agglutination, was obtained after some subculturing. Unfortunately the man disappeared soon after the material was taken so that no history or further samples could be obtained. As far as could be established, he was well.

On one occasion cholera-like germs were obtained. This was from a contact to our No. 127 cholera case, admitted on August 24. From a solid brown stool voided by the contact on Aug. 24, bacilli resembling cholera vibrios morphologically and culturally were obtained; repeated agglutination proved negative.(4)

II. Results of water examination.

We found the technique recommended by the German regulations (1) useful: 1000 c.c. water to be examined were collected in a large sterile flask. To this 100 c.c. of the peptone stock solution were added and the contents after thorough shaking distributed in small flasks of 100 c.c. Examination after an incubation of 8 and 24 hrs. Films were

(4) A strain somewhat resembling cholera bacilli was obtained also from patient No. 206 on September 13 from liquid stool showing many mucous floccules some of which were blood stained. Clinical diagnosis: Dysentery. The bacilli in question were not typical in appearance, being more crescent-shaped with somewhat pointed ends and showed non-luxuriant growth. So the negative agglutination test merely confirmed our conviction that we were not in the presence of cholera. On the next day typical dysenteric stool, containing neither cholera-like germs nor amoebae. Diagnosis: Bacillary dysentery.

taken and the flasks which showed suspicious growths were proceeded with as in the case of stools.

No positive results were obtained from two houses, in each of which several cholera cases had occurred (one examined twice), or from the river Sungari. However, from the river water we obtained on two occasions bacteria much resembling the cholera vibrio. Repeated agglutination tests proved negative. A classification of these germs and those obtained from the contact has not yet been concluded.

III. Results of urine examination.

The findings of albumen and acetone are shown in the accompanying table. The samples were almost all pale in colour and of low specific gravity. Reaction uniformly acid. Even when only traces of albumen were present, usually a number of renal casts and also renal epithelia were seen in the deposit. Blood was once found; the woman in question was possibly menstruating. Diazo reaction was negative in several cases tested. Indican was only rarely slightly augmented, chlorides almost always normal in quantity.

IV. Post mortem examinations.

Altogether we performed 14 *post mortems* upon individuals in whom cholera had been diagnosed or suspected. Of these eight proved positive, one suspicious, five negative.

Little need be said about the negative cases. The two dissected in our hospital both showed purulent peritonitis due to dysenteric ulcers of the intestine. Of the three seen at the Municipal Hospital the first had a chronic cholecystitis and cholelithiasis; death was apparently due to the passing of a gallstone, the diseased heart of the patient (lipomatosis and myodegeneration due to atheroma) being unable to overcome this crisis. The second showed croupous pneumonia, leading to septicaemia and colitis. The third patient was an old man with emphysema, chronic bronchitis and bronchiectatic cavities, and myodegeneration of the heart, who could not withstand an attack of subacute gastroenteritis. Investigation for cholera vibrios proved negative in his case.

The records of the cholera cases including a suggestive but bacteriologically negative one are as follows :

N.B.—In every case except No. 4 the diagnosis of cholera was confirmed by bacteriological tests.

(a) Pinchiang Hospital.

Clin. No.	Sex & Age	Date	Extract from clinic. History :	Important p.m. findings :
1. 1	M. 59	Aug. 7	Admitted Aug. 6 with typical cholera symptoms. Died in the collapse stage on forenoon of Aug. 7.	Permission obtained for partial p.m. only. Ileum shows typical cholera lesions. Severe enteritis in colon. Severe degeneration of kidneys. Spleen congested.
2 37	M. 61	Aug. 16	Admitted with severe typical symptoms on Aug. 14, when ill for 3-4 days. Rec. three infusions, yet could not overcome collapse stage. Very marked albuminuria (½ vol.).	Emphysema and hypostat. pneumonia. Lipomatosis and parenchymatous degeneration of ht. muscle. Fatty degeneration of liver. Spleen not enlarged but somewhat soft and congested. Acute parenchymatous nephritis. Many submucous haemorrhages in stomach. Serosa of ileum injected in parts; mucosa changes also only at spots, elsewhere the mucosa not swollen and rather pale. Contents liquid, stained. Colon free. In rectum submucous haemorrhages and some ulcers, app. chronic in nature.
3 56	M. 25	Aug. 24	Admitted Aug. 18 with severe typical symptoms. 3 infusions. Somewhat better next day but had to be injected again on Aug. 20. Diarrhoea and vomiting then stopped. On Aug. 23 delirium set in and symptoms of pneumonia (bloody expect.) became manifest. Died same day. Was apparently a drinker.	Extensive confluent lobular pneumonia in both lower lobes; foci also in upper lobes; acute emphysema. Hypertrophy of left ventricle of ht.; myodegeneration. Liver rather hard, shows at places fatty degeneration. Spleen somewhat soft, not congested. Large white kidney. Pancreas indurated. Bladder contains urine. Serosa of ileum shows sl. injection at places, mucosa extensive inflammation. Contents yellowish brown with admixture of mucous floccules. Colon not changed with greenish liquid contents. Stomach almost empty; injection of submucous vessels. This was apparently a drinker suffering from chronic parenchymatous nephritis.

(*b*) *Municipal Hospital :*

Clin. No.		Sex & Age		Date	Extract from clinic. History :	
4	4	M.	25	July 27	Had left Shanghai about 5 days ago. Fell sick during journey with vomiting and diarrhoea. Sent from station to Hospital where he seemed rather suspicious for cholera. Bact. exam. negative. Adm. July 20, died 26th with symptoms of uraemia.	Acute haemorrhagic gastroenteritis, specially of ileum and colon. Submucous haemorrhages in stomach. Hypostatic pneumonia. Lung oedema. Acute nephritis. Parenchymatous or early fatty degeneration of the organs. Examination of intestinal contents negative for cholera.
5	16	F.	40	Aug. 12	Nurse of surgical ward. Collapsed suddenly with vomiting and diarrhoea on Aug. 11, died same day.	Partial p.m. shows typical appearances in the small intestine. Stomach and colon free. Parenchymatous or early fatty degeneration of organs.
6	8	M.	67	Aug. 12	Patient admitted to internal ward of Hosp. on Aug. 2 for chronic gastritis. Cholera history same as in Case 5.	Partial post mortem. Only moderate injection of ileum serosa. Small intestines seem somewhat contracted. Severe desquamative enteritis in ileum. Other organs not seen.
7	13	M.	25	Aug. 13	Admitted on Aug. 8 with typical cholera symptoms. Died on 11th, evidently of uraemia.	Partial post mortem. Serosa of intestine only moderately injected; also the mucosa shows severe catarrh only at places. Contents liquid, yellowish. Submucous haemorrhages in stomach. Acute parenchymatous nephritis. Fatty degeneration of liver. Spleen congested and soft.
8	1	M.	34	Aug. 13	Patient admitted on April 13 for tbc. of lungs and intestine. Developed cholera symptoms on Aug. 12, died same day.	Chronic tbc. of lungs. Tbc. ulcers of intestines. Amyloidosis of liver, spleen and kidneys. Ileum almost free. Typical rice-water cont.
9	57	M.	41	Sept. 8	Sailor, admitted with typical symptoms on Sept. 5 on 4th day of illness. Drinker. When admitted severe symptoms and typical stools. Later on stool liquid, *bloody*. Could not overcome collapse stage and died on Sept. 6.	Partial p.m. Chronic catarrh of stomach. Submucous haemorrhages near the pylorus. Serosa of ileum only partly injected. Acute desquamative catarrh in ileum. Enteritis in jejunum. Submucous haemorrhages both in jejunum and ileum, Severe haemorrhagic inflammation of the descendant colon and sigmoid. Fatty degen. of liver. Spleen somewhat swollen and soft, congested. Acute parenchymatous nephritis.

There is no need to enter here in a discussion of the well-known morbid changes found at *post mortem* in cholera cases. What we wish to stress is the great variability of the essential signs, even in cases succumbing quite early in the disease. Our cases No. 1 and 5 alone may be said to have exhibited all the classical features, though in the former the simultaneous affection of the large intestine has to be noted. The other cases, though most often succumbing in the collapse stage, were in one way or the other not so well marked. In most of these the findings in the small intestine as well as the acute changes in the kidneys and the general signs (marked *rigor mortis,* dryness of the tissues, emptiness of the bladder, etc.) would have left little doubt as to their cholera nature, even if their history had not been known. If, however, cholera intervenes in individuals already suffering from certain diseases, the diagnostic task confronting the pathologist might become indeed difficult. This holds true of our case No. 8. This man suffered from amyloidosis as well as lung and intestinal tuberculosis. It is true that in his case the kidneys were softer and more hyperaemic than is usual in such cases, but this was not conspicuous. The rice-water stools were charactertistic but the complete absence of acute changes in the intestinal wall might suggest otherwise. Case No. 3, showing chronic nephritis, could not have been misinterpreted because of the presence of intensive inflammation in the ileum and signs of desquamation (plentiful admixture of mucous floccules in the liquid, yellowish-brown stools.)

In addition to the small intestine, especially the distal portion, changes may be found in parts of the large intestines. These were either due to the same acute cholera infection or were already existent. The aetiology of the severe haemorrhagic inflammation found in Case 9 in the descending colon and sigmoid is not yet histologically elucidated. These changes, though seemingly acute, are in all probability not *directly* caused by the cholera infection. The individual in question was a drinker who, while ill at home for three days, tried to cure himself with strong alcoholic concoctions.

The inflammatory changes found in the large intestine as well as the submucous haemorrhages in the stomach and intestine in several cases (2, 7, 9) attracted our special attention as they suggested the cholera nature of Case No. 4, observed some time before the presence of the epidemic in Harbin was fully established. At the time we performed autopsy (No. 4) we were sceptical as to its cholera nature owing to the decidedly haemorrhagic lesions in the ileum, coecum and ascending colon. Everywhere the mucosa was suffused with blood. Later on, when comparing the findings of this case with those in established cholera cases succumbing sometime after the onset, we became rather suspicious, though three bacteriological examinations had proved negative, and the serum of the patient had failed to agglutinate cholera bacilli.

V. Preparation of Vaccines.

During the epidemic our Laboratory prepared from local strains over 60,000 doses of anti-cholera vaccine for distribution among employees of the Railway, Municipality, Police, Soldiers and other inhabitants in the district. Supplies were also sent to Outstation hospitals including Newchwang. Judging by the number of persons receiving prophylactic inoculations we feel that the public has come to appreciate this means of prevention. We found the reaction in all cases to be slight and, as far as we know, no person who had received inoculation, developed cholera.

SUMMARY OF LABORATORY FINDINGS.

I. Examination of stools.

	Total.	*Positive.*	*Negative.*
(*a*) Patients	40[a]	28	12
(*b*) Personnel	14	0	14
(*c*) Contacts	43	2	41[b] (5% positive)

II. Examination of water.

(*a*) From houses	3	0	3
(*b*) From river	2	0	2[c]

III. Examination of urine.[a]

	Total.	*Positive.*	*Traces.*	*Negative.*
Albumen	45	20	13	12
Acetone	45	4	0	41

IV. Post mortem examinations.

Total.	*Positive.*	*Suspicious*	*Negative.*
14	8	1	5

R. POLLITZER,
(*Bacteriologist, P.P.S.*)

(a) In a number of other cases examinations were made by the clinicians.
(b) Once cholera-like germs obtained.
(c) One both occasions choleia-like germs isolated.

INVESTIGATIONS ON THE VITALITY OF VIBRIO CHOLERAE ON CHINESE PAPER MONEY.

It is well known that the vibrio cholerae when dried on solid objects dies off in a comparatively short time. Numerous investigations, mostly experimental, dealing mainly with the vitality of vibrio cholerae on solid victuals confirm the fact. Of course, the small degree of moisture frequently present on the surface of such objects may delay considerably its death.

Thus, these microorganisms may be found alive on the cut surfaces of *fruits* for days or even weeks. Melons seem even to be a good nutrient medium for them (1), if daylight and intensive exsiccation are avoided. Pollak (2), investigating the vitality of vibrio cholerae on different kinds of vegetables and fruits found that these microorganisms were only slightly damaged by diffuse daylight. Especially on the inner leaves of cabbage the bacilli remained alive for a long time (several weeks). Thus the author comes to the conclusion that although the conditions of these experiments were artificial (the victuals being plunged into an emulsion of a pure culture of vibrio cholerae), the results emphasise the risks, which may attend the sale or consumption of fruits and vegetables coming from cholera-infected quarters.

T. P. Mackie & G. Trasler (3) stated that vibrio cholerae smeared over slices of melons remained alive for more than one day.

The vibriones may be found alive at least one day on slides of fresh unwrapped rye *bread* when exposed to the air, up to three days, if the bread was rolled up in paper, and more than a week if laid under a glass shades thus preventing exsiccation (4). Under ordinary conditions cholera vibriones are not alive on bread for more than eighteen hours, according to Bruni (5).

Friedrich (1) observed the decaying of vibrio cholerae on *pastries* at most after 24 hours, only on biscuits they remained alive from 1-4 days.

On damp *clothes* the Cholera bacilli remain alive for a considerable time; on the surface of damp linen they may even intensively proliferate (6).

According to Gamaleia (7), Hesse (8), Berckholtz (9), Germano (10) the spirilla dried on clothes, may live from 1-5 days.

On absolutely *dry surfaces* exposed to intensive exsiccation the spirilla die after a few hours.

Cholera vibriones dried on *glass* are already dead after who hours (5). When intensively exsiccated or exposed to direct sunlight they perish even sooner.

Cholera vibriones dried on *silk* threads in the exsiccator are dead after 2-4 days (12).

When kept on dry *tobacco* and *cigars* the cholera spirilla die very quickly, at most after 7 hours (1). According to Wernicke (13) the vibriones die even more quickly on these objects than on cover glasses. Even on moist cigars and snuff they perish within 24 hours.

The vitality of vibrio cholerae on *paper sheets* is likewise a short one. According to Uffelmann (4) cholera vibriones dried on printing paper were alive for at least 17 hours if kept in a closed book, at least for 23½ hours, if wrapped in an envelope, and if kept on postcards they lived for 20 hours.

It is of practical interest to know, how long vibrio cholerae may live on coins and banknotes.

The vitality of the vibrio cholerae on coins has been already studied. Uffelmann (4) stated that the cholera vibriones perish on coins very quickly, already after 10-30 minutes. On silver or copper coins they disappear—apparently on account of some chemical influences—much quicker than on gold coins.

The vitality of cholera vibriones on *banknotes* has not yet been systematically investigated so far as I know.

This, however, is a question of some importance for North China with its almost exclusive paper currency. Therefore, during the small cholera epidemic in Summer 1926 at Harbin, some experiments were carried out which may be described here.

In these experiments the leading idea was to imitate natural conditions as far as possible. Almost all of the upper mentioned authors had used pure cultures of vibrio cholerae for their investigations Thus the concentration of the bacilli on the contaminated objects was a far higher one than generally occuring under natural circumstances. For this reason no cultures of bacilli were used in the following investigations but exclusively *fresh stools*, obtained from cholera patients. These excrements were used for contamination of 5-cent-banknotes, which are frequently in circulation and, therefore, very dirty. For that purpose, 20 banknotes were cut into slips and used without previous sterilisation. The method of contamination, refered later on in detail, tried to imitate likewise natural conditions as far as possible. After contamination the slips were either directly exposed to diffuse daylight, or rolled up in paper.

EXPERIMENT No. I.

A typical rice water stool containing a considerable amount of cholera vibriones was used.

Data about the bacteriological investigation of this stool: Microscopical findings in a mucous flake: Among numerous bacteria of different kinds a small number of vibrio-shaped bacilli are to be seen. Four test tubes, containing peptone water, each inoculated with one loop of stool (mucous flake), showed beginning homogeneous cloudiness already after two hours, becoming more and more intense during the following two hours. After 3 hours' incubation to one of these tubes one drop of a cholera agglutinating serum (titre 1 :3000) was added. Soon typical agglutination with rather big flakes was observed. A microscopical preparation, made from the surface of another of these tubes, showed typical cholera vibriones almost in pure culture. Thus the diagnosis was confirmed four hours after inspection of the stool. After 3, 4, and 6 hours agar plates were inoculated with material from the peptone water tubes.

The results on the following morning were:

1st plate, inoculated after 3 hours: Almost pure culture of vibrio cholerae. Immedicate total agglutination of the spirilla by the immune serum 1 :300.

2nd plate, inoculated after 4 hours: Practically pure culture of vibrio cholerae. Immediate agglutination with 1 :300 immune serum.

3rd plate, inoculated after 6 hours: vibrio cholerae and other contaminating bacteria present.

Methods of contamination:

1st series. The tips of the thumb and the forefinger were dipped for a moment into a flat Petri dish containing the cholera stool. Some seconds afterwards a slip of a banknote was touched with the same fingers, and then laid into a dry, sterile Petri dish. Then the tips of the fingers were dipped once more into the cholera stool and so on. Thus numerous slips were treated and thrown into the Petri dish. The latter was kept in a somewhat darker corner of the laboratory. From time to time a slip was taken out of the Petri dish and thrown into a peptone water tube.

2nd series: The method was almost the same as in I. There was but one difference: A platinum loop was dipped into the stool, and the material, thus obtained, was ground well between thumb and forefinger, until the fingers became entirely dry. Immediately afterwards a slip of a banknote was touched and so on.

Course of the experiment: After 10, 20, 30 minutes, 1, 2, 3, 4, 5, 6, and 9 hours, slips of series I as well as of series II were thrown into tubes of peptone water. After 3-6 hours, according to the beginning and the intensity of the cloudiness, one or more loopfulls of the material from the upper part of the peptone water were inoculated on Agar-and Dieudonné plates. After 2-3 hours the tubes: series I, 10 min, 20 min, and 30 min, and series II, 10 min show already a slight but typical homogeneous cloudiness. Microscopically agglutinable vibriones could be immediately demonstrated in these tubes.

Findings on the inoculated plates on the next morning :

AFTER 10 MIN.

1st. Series.	*2nd. Series.*
50 typ. colonies of vibrio chol. 200 contaminating colonies.	Subculture on Dieudonné-plates shows almost exclusively colonies of vibrio chol., giving immediate agglutination with 1 :300 immune serum.

AFTER 20 MIN.

Mixed colonies, out of which one third typical colonies of vibrio cholerae. Subcultures show immediate agglutination with imm. ser. 1 :300.	50 col. of vibrio chol. 10 colonies of bact. coli. Subcultures show immediate agglutination with imm. serum 1 :300.

AFTER 30 MIN.

The Dieudonné-plate shows 20 colonies of vibrio chol. in pure culture; immediately agglutinated by immune serum 1.300.	Colonies of vibrio chol. mixed with colonies of other bacteria; subcultures from vibrio chol. colonies immediately agglutinated by 1 :300 immune serum.

AFTER 1 HOUR.

Numerous contaminating colonies; after several subcultures v. ch. was obtained in pure culture and identified by agglutination.	No vibr. chol.

AFTER 2 HOURS.

Contaminating colonies of different bacteria all about the whole plate.	No vibr. chol.

AFTER 3 HOURS.

Almost pure culture of typical colonies of vibrio chol. showing immediate agglutination with 1 :300 immune serum.	Highly contaminated; no vibrio cholerae cultures to be found.

AFTER 4 HOURS.

Practically pure culture of typical vibrio cholerae colonies, identified by agglutination.	No vibr. chol.

AFTER 6 HOURS.

No vibr. chol. No vibr. chol.

AFTER 9 HOURS.

No vibr. chol. No vibr. chol.

The agglutinatory power of the strain of vibrio cholerae, cultivated from a slip of a banknote, 4 hours after contamination was compared with that of the original strain. The immune serum used in this case had the titre 1 :2000-1 :3000.

When the 16 hours old cultures of either of the strains were added to the immune serum, in both cases immediate agglutination was observed in the tubes 1 :100-1 :300, after one minute in the tubes 1 :500, and after 10 minutes in the tubes 1 : 1000, and after 30 minutes in the tubes 1 :2000. On the next morning in the tube : "original strain 1 :3000" marked agglutination was observed, while in the tube : "strain from paper money 1 :3000" the phenomenon of agglutination was less marked.

Results of the agglutination experiment : The original strain showed perhaps a little higher degree of agglutinability, anyhow, there was only a very slight difference, if at all between the original strain and that cultivated from the contaminated banknote.

EXPERIMENT No. II.

The same series of experiments were performed as in E.I. but with a cholera stool, *containing only very few cholera vibriones*. The methods applied were the same as in E.I. with but one modification : The contaminated slips were wrapped into a sheet of a newspaper which was exposed to the daylight.

Data about the investigation of the stool : Rice water stool, showing microscopically bacilli, cocci, and spirilli. Tubes of peptone water showed only after 6 hours a beginning cloudiness due to the proliferation of a big bacilliform bacterium. 3 and 4 hours after inoculation agar plates were inoculated with material from the surface of the peptone water. After 20 hours incubation a very small number of typical colonies of vibrio cholerae were found on them, and identified by agglutination, and besides it numerous contaminating colonies. Plates, cultivated 6 hours after contamination showed prevailing colonies of different kinds of bacteria, but no colonies of vibrio cholerae could be cultivated from them.

30 min., 1, 2, 3, 4, 6, and 9 hours after infection two slips from the banknotes, inoculated by the two different methods, were taken out of the wrap, and thrown into tubes of peptone water. After 3-4 hours' incubation agar—and Dieudonné plates were inoculated with material from the surface of the tubes.

Results : Vibrio cholerae was alive on the banknotes up to one hour after contamination with the cholera stool (identification of the vibriones by culture and agglutination). After two and more hours no cholera bacilli could be found by the enrichment method.

CONCLUSIONS :

1. The cholera vibriones when dried on banknotes, touched by fingers infected with cholera stool, remained alive up to 4 hours.

2. Vibrio cholerae, cultivated from banknotes 4 hours after contamination showed the same cultural and serological qualities as the original strain.

3. During cholera epidemics the use of banknotes is not entirely free from danger.

REFERENCES :

1. *Friedrich.* Arbeiten aus dem kais. Gesundheitsamte, Bd. 8, p. 465.
2. *Pollak, F.* Centralblatt fuer Bakt. Orig. Bd. 66, 1912 p. 491.
3. *Mackie, F. P., & Trasler, G.* Ind. Med. Gaz. 1922, 121.
4. *Uffelmann* Berl. klin. Wochenschrift 1892, No. 48.
5. *Bruni, N.* Giorn. Med. Milit. 1925, IV.
6. *Koch, R.* qu. Rosenau, Preventive Medicine and Hygiene 1923 p. 143.
7. *Gamaleia,* Deutsche Med. Wochenschr. 1893, p. 1250.
8. *Hesse,* Zeitschr. fuer Hyg. 1894, Bd. 14. p 30.
9. *Berckholtz,* Arb. aus d. kais. Gesundheitsamte, Bd. 5, p. 1.
10. *Germano,* Zeitschr. f. Hyg. Bd. 26, 281, 1897.
11. *Kolle, W. & Schuermann, A.* in Handbuch d. path. Mikroorg. 1912, Bd. IV.
12. *Kitasato* Zeitschr. f. Hyg Bd 3, 1888
13. *Wernicke.* Hyg. Rundschau, 1892 No. 21.
14. *Gotschlich* in Handb. d. path. Mikroorg. II. Anfl. Bd. I, p. 273 ff.

H. M. Jettmar,
(*Serologist, M.P.P.S.*).

THE SCARLET FEVER PROBLEM IN THE FAR EAST.

Reprinted from the National Med. Jl. of China, Vol. XI, No. 6, 1925.

Although Scarlet fever is mild and rarely seen in the Southern provinces of China, it causes severe widespread epidemics in the North. The paper by Yang Ting Kuang and W. H. Shin (21) shows that scarlet fever is very rare in Hongkong, (during years 1912-1922, out of 15,492 cases of infectious diseases only 41 cases of Scarlet fever were recorded). Some of these few cases might have been imported, as this disease is practically unknown among the native population of Kwangtung.

In the Central Provinces, with temperate climate, Scarlatina is more frequent during the cold season. Here numerous outbreaks often show a high mortality. For instance, from 1905 to 1917 the mortality among foreign patients at the Shanghai Isolation Hospital amounted 18.5% (583 cases, 118 deaths). The 1924 Annual Report of the Shanghai Public Health Department shows an increase in the incidence of Scarlet fever. Of 45 Chinese cases admitted to the Chinese Isolation Hospital, there were 8 deaths (17.8%). According to this report, Scarlet fever in Shanghai is often of an intensively virulent nature, the mortality ranging from 8-25%.

In spring 1917 a severe epidemic of malignant scarlet fever arose in Hankow (Hupeh) with numerous fatal cases among the native as well as foreign population. Severe epidemics were also reported from Sining (Kansu), breaking out usually in autumn and winter. The 1916 epidemic there, for instance, killed hundreds of children (5).

The province of Chihli is likewise severely affected by Scarlet fever. The statistics of the Hospital for Infectious Diseases (Peking) show a mortality of 18.9% in 1923. The same applies to Tientsin. In 1916 and 1920, larger epidemics occurred in the area of the South Manchurian Railway with a relatively high mortality: Tsurumi (19) reported an average mortality of 12.2% from 1911-19 (1249 cases with 153 deaths).

In Harbin, as elsewhere in North Manchuria, its severity varies. While it may be quite benign sometimes among Russians, on other occasions its claims an exceedingly high mortality. The Reports of the Harbin Town Infectious Disease Hospital, kindly supplied by Dr. Bergmann, demonstrate this fact in an effective manner:

TABLE I. HARBIN MUNICIPAL HOSPITAL. SUMMARY OF SCARLET FEVER PATIENTS TREATED.

	No of patients :								Died :								
Year	Adults m.	Adults f.	Children	Russians	Chinese	Jews	Other nat.	Total	Adults m.	Adults f.	Children	Russians	Chinese	Jews	Other nat.	Total	Mortal %
1918	—	—	20	7	1	12	—	20	—	—	2	1	—	1	—	2	7.0%
1919	—	1	17	11	—	4	3	18	—	—	—	—	—	—	—	—	0.0%
1920	2	5	15	15	—	5	2	22	—	—	1	1	—	—	—	1	4.55%
1921	1	5	30	20	2	14	—	36	1	1	2	2	2	—	—	4	11.11%
1922	5	3	51	42	2	10	5	59	—	—	6	3	2	1	—	6	10.19%
1923	2	4	98	66	—	34	4	104	1	—	16	15	—	2	—	17	16.35%
1924	6	7	103	90	2	16	7	116	1	—	15	14	1	1	—	16	13.79%
1925*	5	3	106	80	8	16	10	114	1	1	7	3	4	—	1	8	7.01%
* I-Vth month																	
Total	21	28	440	331	15	111	31	489	4	1	49	39	9	4	8	54	11.04%

The high morbidity of scarlet fever among the Russian population in Municipal area of Harbin (average Population 50,000-86,000) is shown as follows :

TABLE II. INCIDENCE OF SCARLET FEVER AT HARBIN (PRISTAN AND NEW TOWN) 1909-1924.

Year.	cases.	Year.	cases.	Year.	cases.	Year.	cases.
1909	201	1913	313	1917	119	1921	202
1910	269	1914	321	1918*	51	1922	149
1911	337	1915	152	1919*	75	1923	270
1912	222	1916	116	1920*	103	1924	218

* Incomplete. Average number per 1,000 of population for 16 years = 2.85.

Among the Chinese population in Harbin the attacks of scarlet fever have usually been of a severe character, as has been personally observed by us.

Generally speaking scarlet fever is more severe in North China than in corresponding parts of Europe and America. For instance the Austrian Public Health Reports show that the total number of scarlatina cases from April 12th to May 16th, 1925 were 752, of which 3 died (0.3%).

Also in Western Europe, North America and Australia, Scarlet fever appears in a comparatively mild form as may be seen from the

available data drawn from the Annual Report 1924 of the League of Nations :

England 1923 cases 85,603 ......deaths 993 = 1.17%
Canada 1924 cases 17,340 ......deaths 393 = 2.26%
Australia 1923 cases 6,634 ......deaths 45 = 0.69%
New Zealand 1924 cases 1167 deaths 13 = 1.11%

On the other hand, in Japan, though Scarlet fever is not so very prevalent, the type is also more severe than in Western Europe as may be seen from the figures :

INCIDENCE OF SCARLET FEVER IN JAPAN, 1919-1924 (14).

Year	*Cases*	*Deaths*	*Fatality rate*
1919	1,325	109	8.2%
1920	1,368	90	6.6%
1921	1,589	82	5.2%
1922	1,657	97	5.2%
1923	1,562	88	5.6%
1924	1,843	121	6.6%

KOREA STATISTICS :

Year	*Cases*	*Deaths*	*Fatality rate*
1920	371	106	28.6%
1921	717	209	29.1%
1922	585	239	40.4%
1923	1,008	242	25.0%
1924	1,361	338	24.8%

Such high morbidity and mortality in the Far East call for the need of fighting this infection with all weapons provided by modern science.

Investigations on Scarlet fever have produced important results during the last few years. Tests have been introduced which enable us to determine the individual susceptibility to scarlatina (Dicks' skin test). Other tests (Schultz-Charlton blanching phenomenon, Pastia's sign) have been introduced for diagnosis. In America special emphasis has been laid upon the important role by Streptococcus haemolyticus in the causation of this disease. On the basis of these investigations, and partly independently of them, a new thereapeutic scheme has been worked out.

Owing to the important results which may be expected, our chief, Dr. Wu Lien Teh, has suggested a thorough study in Harbin and Manchuria of this problem.

Our investigations are not yet completed, and only a preliminary summary is therefore be given here.

The frequency of Streptococcus haemolyticus in Scarlet fever patients was noted already in 1885 (Crooce). According to Jochmann (12) in 70% post-mortems St. haem. was found in the organs of scarlet fever corpses. Since 20 years ago, when the use of Schottmueller's blood agar plates was adopted, fuller knowledge about the frequency and biological features of *St. haem.* in the throat and tonsils of scarlet fever patients was possible.

Gordon (11) found in nine out of ten tonsillar swabs abundant colonies of St. haem. (90%). In four of these streptococcus haemolyticus exceeded all other bacteria grown on the plate.

Dochez and Sherman (9) say that during a certain period of the disease St. haem. is to be found in every case and shows distinct biological features. Bliss and Bristol (5) found *St. haem.* in 100% (often in pure cultures) in swabs from throats of scarlet fever patients.

Our own investigations so far carried out in Harbin tend to confirm the above statements, as may be seen from the figures supplied later on.

Cotton swabs were prepared for taking the material from the pharynx without touching the tongue or other parts of the mouth, and examined within three hours. In every case rabbit blood agar recently poured into plates was used. (I. c.c. of defibrinated blood mixed with 5-6 c.c. of agar). The throat material was then swabbed over the surface of the first plate. 5 more plates were inoculated in succession with a sterile bent glass rod which had been rubbed over the surface of the first plate.

TABLE III.

No	Race	Age	Sex	Res.	Date material taken	Days sick	Growth of St. haem	practically pure cult. on plates:	Remarks
1	Ch.	6	m.	d.	19.VI.	4	pos.	3.4.5.6	O. P. Parents refused to keep him at hosp. died at home.
2	R.	8	m.	r.	21.VI.	5	pos.	4.5.6	
3	R.	3	m.	r.	23.VI.	5	pos.	(1.2)3.4.6	
4	Ch.	22	f.	d.	27.VI.	3	pos.	4.5.6	
5	Ch.	8	f.	d.	27.VI.	4	...		
a) sl. fr. nose							pos.	5.6	Relatives of case I; stay hospital refused, died at home.
b) sl. fr. thorat							pos.	4.5.6	
6	R.	11	f.	d.	8.VII	6	pos.	mixed	Swabs taken 12h before death,; thick membr. on throat.
7	R.	4	f.	r.	8.VII		pos.	3.4.5.6	Mild.
8	R.	8	f.	cr	9.VII	11	pos.	2.3.4.5.6	Mild myocarditis; recovered quickly.
9	R.	10	m.	c.					
a) first swab					22.VII	9	pos.	4.	Adenitis, pyemia, thick memb, on throat.
b) second swab					5.VIII	23	pos.	contam.	
10	R.	6	f.	cr	27.VII	4	pos.	2.3.4.5.6	Adenitis.
11	R.	10	f.	r.	30.VII	5	pos.	2.3.4.5.6	Mild, without comp.
12	R.	6	m.	r.	4.VIII	5	pos.	3.4.5.6	
13	R.	4	f.	cr	10.VIII	7	pos.	mixed	Plenty memb. severe case, mixed with diph. like bac.
14	R.	4	m.	r.	10.VIII	6	pos.	3.4.5.6	
15	R.	$1\frac{1}{4}$	m.	d.					
1st. investigation					12.VIII	4	pos.	(3)4.5.6	Died on 12th. day of disease.
2nd. investigation					18.VIII	10	pos.	5.	
16	R.	$2\frac{3}{4}$	f.	r	19.VIII	15	pos.	2.3.4.5.6	
17	R.	$3\frac{1}{4}$	m.	r.	19.VIII	8	pos.	2.3.4.5.6	Mild.
18	R.	9	m.	r.	7.IX	7	pos.	contam.	Plates contam with num. small colonies of small streptobac

d = died; r = recovered c = complication R = Russian Ch = Chinese.
O.P. = outpatient.

These figures show that in every one of our cases (21 examinations) St. haem. was present in the throat (100%). In 17 of these, streptococci were found in practically pure culture on the last plates of the set (81%). It is significant that in cases with thick membranes more contaminations and mixed infection were seen than in the mild cases with no membranes. The purest cultures were as a rule obtained in the early stages of the disease (4-5th day). Sometimes in later stages of mild cases (8-15th day, see cases No. 16, 17) practically pure cultures of St. haem. were obtained from the tonsils.

Stevens and Dochez (18), Bliss (4), Tunicliff (20), Gordon (11) etc. emphasize that the streptococcus of scarlet fever serologically represents a specific type which is differentiated mainly by agglutination and absorption of agglutinin test from other streptococci.

Morgenroth, Schnitzer and Munter found that in mice, when St. haem. changes into a green producing type, there is considerable loss of virulence.

If we could elaborate a method by which such a change could be quickly produced in the human organism, an excellent remedy against scarlet fever would then be available.

G. and G. Dick were able to produce scarlet fever-like phenomena in human beings by planting upon the naso-pharyngeal mucous membrane of several volunteers a culture of St. haem., obtained from scarlet fever patients. Thus all Koch's postulates seem to have been fulfilled by them.

These authors also made numerous studies on the toxin of these streptococci. They state that the toxin has certain features and when filtrated can be applied as follows (Zingher 22):

(1) Determination of the susceptibility and immunity to scarlet fever.

(2) Active immunization with sc.f. toxin and determination of its effect.

(3) Help in the diagnosis of doubtful cases of scarlet fever.

(4) Studies on the nature of scarlet fever toxin and anti-toxin.

(5) Standardizing the anti-body content of anti-toxic serum.

(6) Identification of St. haem. from doubtful cases of scarlet fever.

(7) Epidemiologic studies: Determination of the presence of specific St. haem. in normal throats (carriers) and in patients with scarlatina sine exanthemate.

(8) Studies on the germs of postscarlatinous infection.

Out of these applications of Dicks' toxin, the first is of great importance. If the susceptibility to scarlatina is determined by systematic investigations, susceptible persons, especially in schools, institutions and communities might be immunized. This would help to prevent the dis-

tribution of this disease as in the case of Diphtheria. Among the lower classes of the Chinese population, where poverty and lack of personal hygiene make other measures difficult, the prophylactic treatment with anti-scarlet fever toxin would be of great use.

For this purpose we have undertaken a large number (nearly 2000) of skin tests among the Chinese of Fuchiatien (Harbin).

At first the original standard toxin which Drs. Dick and Dick kindly presented Dr. Wu Lien-Teh at Chicago was employed. Later on, our own toxin obtained from strain of case 15 (Table III) was used. The strength of this had been compared with the standard toxin on the patients of our hospital at Harbin. For skin tests we dilute the toxin 1 : 1250.

Our studies in this direction are still being pursued, and only a few of the results obtained are given here.

The intradermal tests were made exclusively on the upper arm and were read off within 20-24 hours. They are marked as –, †, ††, †††, just as the Dicks recommend.

TABLE IV. DICK TEST WITH DIFFERENT AGE GROUPS (CHINESE IN HARBIN).

Age.	Dick neg.	Dick positive			Total	Per Cent. Dick posit.
		one	two	three plus.		
1-4	1	1	2	11	15	93.3%
5-9	11	10	9	6	36	69.4%
10-14	95	46	34	19	194	51.0%
15-19	146	113	38	6	303	51.8%
20-24	114	72	36	2	224	49.1%
25-29	87	59	14	—	160	45.6%
30-above	214	94	34	1	343	37.5%

The above shows a high percentage of positive reactions as compared with those made in other countries. We use Zingher's table :

TABLE V. NEW YORK CITY, WILLIAM PARKER HOSPITAL.

Age.	Total tested	Dick pos.	Dick neg.	% Dick pos.
0-6 months	29	13	16	44.8%
6-12 ,,	52	34	16	65.3%
1-2 years	233	167	66	71.6%
2-3 ,,	204	131	73	64.2%
3-4 ,,	241	146	95	60.5%
4-5 ,,	264	128	136	48.2%
5-10 ,,	1955	678	1277	33.6%
10-15 ,,	2965	677	2288	22.8%
15-20 ,,	981	166	815	16.8%
20 years up	776	112	662	14.4%
Total	7700	2252	5448	29.2%

† 1.5 c.m. diam. or under.

†† 1.5 to 3 diam.

††† over 3 c.m. diam.

TABLE VI. ROSEN AND COROBICINA.

Children of the closed Infants' Home in Moscow. 1187 cases.

Age.	No tested	% Dick pos.	Age.	No tested	% Dick pos.
0-1 year	68	47.0	7-8 years	203	53.2
1-2 years	38	68.8	9-10 ,,	289	43.2
2-3 ,,	43	65.1	11-14 ,,	339	38.3
3-4 ,,	24	83.3	15-16 ,,	35	48.5
4-6 ,,	100	67.0	19 years up	48	35.4

Our high percentage of positive reaction demonstrates clearly that scarlet fever encounters in North Manchuria a highly susceptible population and may account for the severe nature of the epidemics when they arise.

The age incidence has also been studied as well as the susceptibility among persons from different provinces. The results so far obtained provide interesting food for reflection.

TABLE VII. RESULTS OF DICK TEST IN CHINESE FROM DIFFERENT PROVINCES.

Result :	Chihli	Feng-tien	Kirin	Heilung-kiang	Shan-tung	Fu-kien	Kiang-su	Ho-nan	Hu-peh	Kwang-tung
Dick neg.	287	164	86	12	89	8	7	10	7	9
Dick pos. ...	199	96	53	5	64	7	6	3	3	5
One plus ...										
Two ,, ...	70	32	12	4	23	1	—	3	2	7
Three ,, ...	8	8	5	—	4	—	1	—	—	1
Total	564	300	156	21	180	16	14	16	12	22
%Dick pos	49.1	45.3	44.8	42.8	50.5	20.0	50.0	37.5	41.6	59.0

TABLE VIII. DICK TEST ACC. TO SEXES WITH HISTORY OF SC. FEVER.

	Negative	Positive	Total	% positive.
F.	8	1	9	11.1%
M.	47	3	50	6.0%

TABLE IX. DICK TEST ACC. TO CHINESE SCHOOLS, HARBIN.

Name of school Fuchiatien.	Negative.	Positive. +	++	+++	Total.	% positive.
Mission. High Girl School (age fr. 9-20)	45	20	12	3	80	43.7
Mission. Prim. Girl School (age 7-14).	17	12	14	8	51	66.6
Government Orphanage (age 9-18)	92	23	10	6	131	29.7
Commerc. School (age 15-30)	88	56	10	—	154	45.8
Chi Yeh School (age 10-16)	69	32	2	—	103	33.0
Mission. Kindergarten. (age 3-6)	3	6	8	6	23	86.1

TABLE X. DICK TEST AMONG CHINESE BOYS AND GIRLS.

Age.	Negative.	Positive.	Total.	% positive.
0-1	—	—	—	—
1-2	—	—	—	—
2-3	—	4	4	100.00
4-5	2	11	13	84.6
6-7	22	52	74	70.2
8-9	38	60	98	61.2
10-11	42	50	92	54.3
12-14	101	48	149	32.8

Another practical application of Dick's toxin is the aid it renders in diagnosing doubtful cases of scarlet fever. A strong positive reaction during convalescence from an illness with a scarlatiniform rash would probably point against the diagnosis of scarlet fever. This test is a valuable adjunct of Schultz and Charlton's blanching phenomenon for later stages of the disease.

Owing to lack of suitable material we cannot at present report upon this test.

In 1911-12 the application of high doses of convalescent serum was introduced by Reiss and Jungmann (16) into the therapy of scarlet fever. They injected 50-100 c.c. intravenously and obtained

good results. The convalescent serum had been used since the end of the last century but had always been injected in small quantities. (Leyden, Weissbecker, Huber and Blumenthal, Schultz a.o.) For that reason, only a few good results had been reported.

Many authors (Koch, Bode, Mironescu and Sagar, Bernbaum Langer a.o.) have confirmed the observations of Reiss and Jungmann.

Degkwitz says it is possible to produce temporary immunity against scarlet fever by using 5-10 c.c. of convalescent serum (7).

Though the treatment by convalescent serum may be effective in many cases its wide application is doubtful for it develops full power only at the beginning of the illness and is inefficient against the complications of scarlet fever. Moreover it is often difficult, especially for small hospitals, to provide convalescent serums from undoubtedly healthy persons.

The investigations of Dochez (9) are therefore heartily welcomed. This author and his associates have introduced a new method of producing an anti-streptococcic serum by immunizing horses with living streptococci after liquid agar had been introduced into the animal. *Blake* (2), *Blake, Trask* and *Lynch*, (3), *Birkhaug* (1) have obtained very good results with this serum. We have likewise used this serum provided by Eli Lilly (Minn.) upon patients at Harbin Municipal Hospital, and have seen encouraging results. But the cases are as yet too few to be commented upon.

The investigations of the last few years have produced a new conception of scarlet fever. It may now be considered as a local infection of the nase-pharynx in which a soluble toxin is produced. This is absorbed into the system of the patient where it gives rise to the rash and other constitutional symptoms (quoted by Zingher (22)).

This conception supports the advocacy of early local disinfection of the throat. Investigations on *St. haem.* lately published by Kuestner state that the virulence of these germs is increased by growing on decaying tissues (13). This fact may explain why streptococci have such a destroying power on necrotic tonsils. Probably more stress will be laid in future on the finding of an active agent for throat disinfection (Milne, Elgart (10)).

In conclusion, we wish to acknowledge our indebtedness to our Chief, Dr. Wu Lien Teh, for his constant advice and supervision in the course of our researches.

SUMMARY.

1. We have found Streptococcus haemolyticus in every one of the 18 cases of Scarlet Fever investigated. Out of these 18, 15 showed the organism in practically pure culture.
2. The incidence of Scarlatina in North China is high, both morbidity and mortality showing a higher percentage than countries of the same latitude in Europe and America.
3. Out of 1275 Dick Tests made on the Chinese population in Harbin, ranging in ages from 1 to over 30 years, we obtained positives in

47.7%. This suggests a higher degree of susceptibility among the Chinese residing in this region.

4. We have also conducted Dick Tests among 542 school children of six schools, and found more positives in the kindergarten (86%) than elsewhere.

5. Investigations made of persons from different provinces of China are as yet too few to be of value, but should be prosecuted on the spot with a view to ascertaining their comparative susceptibility, especially between northerners and southerners.

6. Encouraging results have been obtained from Dochez's serum made in America in the treatment of scarlet fever patients, but we are preparing our own serum, so that it may be tried on a more extensive scale throughout North China.

REFERENCES.

1. Birkhaug. Bull. of the Johns Hopkins Hosp. Vol. XXXVI 1923. p. 134-171.
2. Blake, F. G. Boston Med. & Surg. Journal 1924, CXCI p. 43-47.
3. Blake. Trask and Lynch. Journ. of the Am. Med. Ass. vol. 82, 1924, p. 712-714.
4. Bliss. Journ. Exper. Med. 1919, vol. 29.
5. Bristol. Amer. Journ. of Med. Science, 1919 vol. 29.
6. Chinese Med. Journ. 1916, p. 392.
7. Degkwitz, Muenchner Med. Wochenschr. 1922, p. 955.
8. Dick G. & Dick Gl. Journal Am. Med. Ass. 1924, vol. 82, p. 265.
9. Dochez & Sherman, Journ. Am. Med. Ass. vol. 82, 1924.
10. Elgart. Casop. lek. cesk. No. 14. (Ref. D. Med. W., Bd. 39).
11. Gordon M. H. Brit. Med. Journ. 1921, vol. I, p. 632.
12. Jochmann. Infektionskrankheiten 2. Aufl. 924.
13. Kuestner H. Centralblatt f. Gyn. No. 5, 1924.
14. League of Nation Epid. Intell. No. 9, 1924.
15. Morgenroth Centr. f. Bact. Orig. 1924, Bd. 93.
16. Reiss & Jungmann D. Arch. f. klin. Med. Bd. 106, HI/II.
17. Schnitzer & Munter Zschr. f. Hyg. u. Infkh. Bd. 99. 1923, p. 366.
18. Stevens & Dochez The Journ. of Exper. Med. vol. XI. 1924, pp. 253-262.
19. Tsurumi Jap. Journ. of Therapeutics Feb. II. 1922.
20. Tunicliff, Journ. Am. Med. Ass. vol. 74, 1920.
21. Yang Ting Kuang & W. H. Shih; Nat. Med. Jl. of China, 1924, pp. 153-170.
22. Zingher A. Journ. Am. Med. Ass. 1924, vol. 83, pp. 432-443.
23. Rosen & Korobicina. Journ. Am. Med. Ass. 1925, vol. 84. p. 1476.

LIN CHIA SWEE, M.D.
Res. Med. Off., Harbin.
H. M. JETTMAR, M.D.,
Serologist, P.P.S.

REMARKS ON THE SCARLET FEVER STREPTOCOCCUS ANTI-TOXIN.

Reprinted from the National Med. Jl. of China, Vol. XII, No. 2, 1926.

It may be well to dwell shortly on the history of the relationship of Streptococcus hæmolyticus to scarlet fever. In 1884, Loeffler[1] and later in 1895, Marmorek[2] noted that Streptococcus hæmolyticus was frequently present in the throats of acute cases of scarlet fever. Marmorek prepared an anti-streptoccic serum by immunizing animals with polyvalent strains of Streptococcus hæmolyticus isolated from the throat secretions of scarlet fever patients in the acute stage of the disease. Clinical trials with this serum were not promising, however, and it was soon abandoned.

In 1902, Moser[3] re-ëxamined Marmorek's work, and came to the belief that the Streptococcus hæmolyticus associated with scarlet fever was different from Streptococci usually found in other conditions. He therefore immunized a horse with live organisms from strains of Streptococcus hæmolyticus isolated from the blood of fatal cases of scarlet fever and obtained very good clinical results. Even severe toxic cases with doubtful prognosis were benefited. It was noted that after ten to fifteen hours following an intramuscular injection of 30, 100, and even 200 c. c. of the serum, there was a striking fall of the temperature and a rapid abatement in the toxic manifestations. But the serum did not become popular because later tests failed to maintain its reputation and also serum sickness was frequently caused by it.

Savchenko,[4] in 1905, showed that the serum contained both scarlet fever anti-toxin and Streptococci bactericidal bodies. He also proved that the filtered broth in which the culture had grown contained a strong toxin.

Gabritschewsky,[5] in 1907, made a vaccine from the toxin and cells of streptococci obtained from scarlet fever, in fact, bouillon in which the streptococci had grown for four days plus 3% by volume of the streptococci. With this vaccine he immunized 368 children, each receiving three injections at weekly intervals. A small percentage of them developed a scarlet—feverlike rash, sore throat, strawberry tongue, and vomiting. This vaccine was afterwards proved to be useful in immunizing children in a scarlet fever epidemic by Polotovkova.[6]

These and other authors considered the Streptococcus hæmolyticus so frequently found in the throats of scarlet fever patients to be the primary cause of the disease. The great majority of doctors, however, did not support this opinion, for they believed the Streptococcus hæmolyticus to be responsible only for the frequent and dangerous complications of scarlet fever.

More recently, attempts to identify a specific strain of Streptococcus hæmolyticus as the cause of scarlet fever have been made by many workers. The researches of Bliss,[7] Tunnicliffe,[8] Stevens,[9] Gordon,[10] Dochez and Sherman,[11] and Dochez[12] have demonstrated that though the Streptococcus hæmolyticus, cultivated from the throats of scarlet fever patients, does not differ culturally or morphologically from the streptococcus found in tonsillitis or other septic conditions, it does differ, however, serologically, inasmuch as it is agglutinated by sera from animals immunized against streptocococcus obtained from cases of scarlet fever, but not by sera obtained from animals immunized against strains of streptococcus from other sources.

In New York, Dochez[12] succeeded in immunizing a horse by injecting a small amount of liquefied agar into the subcutaneous tissue of the neck and then into the center of the agar nodule thus formed he injected living Streptococcus hæmolyticus. The horse was injected at weekly intervals with increasing doses for two to three months. Then it was bled and the serum obtained was found to be capable of blanching the scarlet fever rash locally when injected intradermally in very small doses, and generally when injected in larger amounts.

With this serum, Blake, Trask, and Lynch[13] at New Haven treated 13 cases of scarlet fever and considered it possessed marked therapeutic value, though the cases were too few, and no control cases were employed.

Birkhaug[14] showed the superiority of Dochez's serum over convalescent serum by treating 31 cases with 80% recoveries, 10% with complications, and 10% deaths in moribund patients; whereas 37 cases were treated with the latter, resulting in 35% recoveries, 59% complications, and 6% deaths.

Park[15] treated 40 cases out of 569 admissions in 1924 when scarlet fever was very light, with a mortality of 2.8%. During April and May, 1925, when all patients of any severity were receiving serum, there were 220 admissions. Of these, six patients, or a percentage of 2.7, died.

Park emphasized that the serum should be tested for potency by the Schultz-Charlton and Dick methods. It should be given in a sufficient amount as early in the disease as possible. When thus given, the results in most cases are strikingly favorable and frequently the development of complications is prevented. It is useless after the rash has disappeared and it has no effect on the later septic complications. In moderate cases it should be given intramuscularly. In severe or toxic cases it should be given intravenously. He noted, however, that serum sickness occurred in 60% after the injection of the unrefined serum and 30% after the injection of the refined serum.

Two other noteworthy workers must now be mentioned. For the last ten years, George Dick and Gladys Dick, of Chicago, have been working on the ætiology of scarlet fever. Within recent years,

they have published many communications in different journals. They found[16] that by swabbing the throats of acute cases of scarlet fever and smearing the swab on blood agar plates, they were able to cultivate Streptococcus hæmolyticus from every one of their 100 cases in 1922 and 1923; 16% of these strains fermented mannite and 84% did not ferment mannite. With these cultures, with blood from early cases, and with ground-up organs from post mortems they attempted[17] to produce experimental scarlet fever in guinea pigs, mice, rabbits. pigeons, and small white pigs. The results did not satisfy them and they were unable to determine the ætiology of scarlet fever.

They decided that animals are comparatively insusceptible to the disease, and proceeded to use human volunteers for the production of experimental scarlet fever.

In 1921,[18] some seventy volunteers were inoculated, some with fresh whole blood and fresh blood serum from acute cases of scarlet fever, and others with filtered throat mucus from early cases. The results of these inoculations were negative. Then pure cultures of scarlet fever Streptococcus hæmolyticus were swabbed on the throats of nine volunteers, but none developed typical scarlet fever.

In 1923,[19] they succeeded in producing two cases (one mild and one moderate) by swabbing the throats of ten volunteers with a pure culture of Streptococcus hæmolyticus isolated from the lesion on the finger of a nurse who acquired the disease while caring for a scarlet fever patient. They also showed that the same culture when filtered through a Berkefeld "V" filter did not cause scarlet fever. This strain did not ferment mannite. Since they found that some strains of Streptococcus hæmolyticus ferment mannite and some do not, they proceeded to inoculate two volunteers in 1924[20] with a strain which fermented mannite and obtained another case of experimental scarlet fever.

From the throat of this volunteer they managed to isolate the Streptococcus hæmolyticus and grow it in pure culture. They claimed that all requirements of Koch's laws were fulfilled and concluded that scarlet fever is caused by the Streptococcus hæmolyticus. It may be remarked, however, that apparently they did not test the serum of their successful experimental cases for neutralizing effect on streptococcus toxin, nor have they tested the effect of the injection of convalescent serum of scarlet fever cases on the rash of these experimental cases.

Their further researches demonstrated that scarlet fever streptococcus produces a toxin. When this toxin is absorbed into the blood, it produces characteristic symptoms of scarlet fever, including the rash.

The toxin was obtained by inoculating plain broth with the strains of streptococci which produced experimental scarlet fever in human beings. After incubation, the broth cultures were passed through Berkefeld filters to remove the bacteria.

The toxin is neutralized by convalescent scarlet fever serum due to the presence of an anti-toxin in the blood of recovered patients. By

standardizing very dilute toxin on human beings, they developed the Dick test for susceptibility to scarlet fever. It consists of an intradermal injection of 0.1 c. c. of the skin test dilution (1 in 1250) on the flexor aspect of the forearm. The reaction is observed within twenty-four hours. An area of reddening, 2 cm. or more in diameter, indicates marked susceptibility; 1 cm. in diameter, some degrees of susceptibility to scarlet fever.

In a series of skin tests, reported in January, 1923, the Dicks found a positive reaction in 41.6% of the persons who gave no history of scarlet fever, and negative or only slightly positive reactions in all the convalescent patients tested. These results have since been verified by many workers in different countries.

The next step they took was to attempt to immunize persons against scarlet fever and they utilized their skin test to determine the development of anti-toxic immunity. They found that, by proper dosage, they were able to immunize persons with positive skin tests so that their skin tests became negative and they did not contract scarlet fever on exposure. They advised for the first injection subcutaneously 1 c.c. dilution containing five hundred skin test doses, for the second fifteen hundred, and a third considerably larger at five days' intervals. If the skin test is still positive after three immunizing doses, the third dose should be repeated or a larger dose may be given, until immunization is carried to the point of a negative skin test. It is hoped that this acquired immunity will last at least for a few years.

The final step consisted of the production of a scarlet fever anti-toxin.[21] A horse was immunized by subcutaneous injections of sterile filtrate from broth cultures of the strains of streptococcus that had produced experimental scarlet fever. The injections therefore consisted of undiluted toxin and were given in gradually increasing doses, beginning with 20 c.c. and increasing to 1 liter. They were administered at intervals of 5-7 days for a few months. After preliminary tests showed that the horse produced a good anti-toxin, it was bled and the serum was concentrated.

They standarized the concentrated serum so that 1 c. c. will neutralize 1,000 skin test doses of toxin. They took this standard because 1,000 skin test doses, if injected into a susceptible subject, will produce general malaise, vomiting, a fever of 101°F. and a scarlatinal rash. They considered a therapeutic dose should be able to neutralize 20,000 skin test doses of toxin and therefore it must be at least 20 c. c. of serum.

They have since tested their anti-toxic serum on scarlet fever patients and compared the results with controls. In moderately severe cases, 21 were treated with anti-toxin, with no deaths, and 4.7% complications, while 35 controls also showed no deaths, but there were 34.1% com-

plications. In severe cases, 29 were treated with anti-toxin, with 3.4% deaths and 13.6% complications, while 15 controls showed 20.0% deaths and 93.3% complications.

They concluded that the anti-toxin is of practical therapeutic value, that it should be given early in the disease before complications have occurred, because it shortens the course of the disease and reduces the number of complications and sequelæ. Since the anti-toxin is concentrated, serum sickness is negligible, and the routine exhibition of anti-toxin should be adopted.

The most important point is the application of prophylaxis. For by immunizing persons, especially those of the most susceptible ages before puberty, scarlet fever and particularly its dangerous complications may be *prevented*.

The scarlet fever problem in China is somewhat different. Being a recent introduction into this country, it assumes a very virulent form both for Chinese and Westerners. The records of the Shanghai Isolation Hospital for 1902-1922 show a mortality of 25.4% among 1,071 Chinese patients and 15.2% among 761 foreign patients. Dr. Arthur Stanley (sometime Health Officer of Shanghai) stated that scarlet fever is characterized by an exceptional variation and in epidemics the case fatality may vary from 30% to nothing, whereas the tendency in England and America is for the type to be less virulent with a case fatality approximating 1%-3%.

According to a survey by Yang and Shih[22] scarlet fever is very rare in South China, possibly due to the hot climate. In Hongkong during a period of twelve years (from 1911-1922) 15,493 cases of infectious diseases were notified, and among these there were only 41 cases of scarlet fever. Doctors in Kwangtung province also report on the exceeding rarity of scarlet fever.

Traveling northward, we find scarlet fever is prevalent in the Yangtze valley; its virulence varies, but is on the whole severe. Coming to North China and Manchuria, we note that scarlet fever is exceedingly widespread, and sometimes very virulent and characterized by severe complications. The Peking Isolation Hospital reports on a case fatality of 20.8% among 638 Chinese patients during 1905-1923. The Dairen Hospital reports a case fatality of 12.2% among 1,249 children under ten years of age during 1911-1919.

In Harbin, among 489 admissions into the Municipal Hospital during 1918-1925, mostly Russians, there were 54 deaths, or 11.04 per cent. Among the Chinese population, scarlet fever is frequently fatal, as observed by us. Sometimes all the children in a family are carried off by it.

Since the autumn of 1925 we have been studying the Streptococcus hæmolyticus in association with scarlet fever. Swabs taken from the throats of 80 scarlet fever patients and cultivated on blood agar gave growths of Streptococcus hæmolyticus in every instance, even as early as the first day of the illness. Drs. Lin and Jettmar of our service have reported on the results of 1,275 Dick tests on Chinese of all ages and obtained 607 positives, or 47.7%. Of 430 children in another series, under 14 years of age, there were 225 positives, or 52.3%. We have also immunized some children after the Dicks' method, but the number is as yet too small to report on.

Through the kindness of the Dicks, who presented our Director with some of their anti-toxin, of Eli Lilly and Company, and of the New York State Department of Health of who supplied us with Dochez's anti-toxin, we have caused 7 Chinese and 8 Russian scarlet fever patients to be treated by this means. The cases were not selected, but were taken as they came.

In considering Table I, we note that there was one death out of a total of 8 cases treated, or 12.5%, and there were 5 cases with complications (62.5%). There was one patient who suffered from serum sickness.

Case No. 3, Kus, recovered in 36 hours; cases Nos. 7 and 8 recovered in 72 hours; case No. 4 in 60 hours, while cases No. 2 and No. 6 took 5 and 9 days, respectively, to get well.

TABLE I. Summary of Russian Scarlet Fever Patients Treated Intramuscularly with Antitoxin.

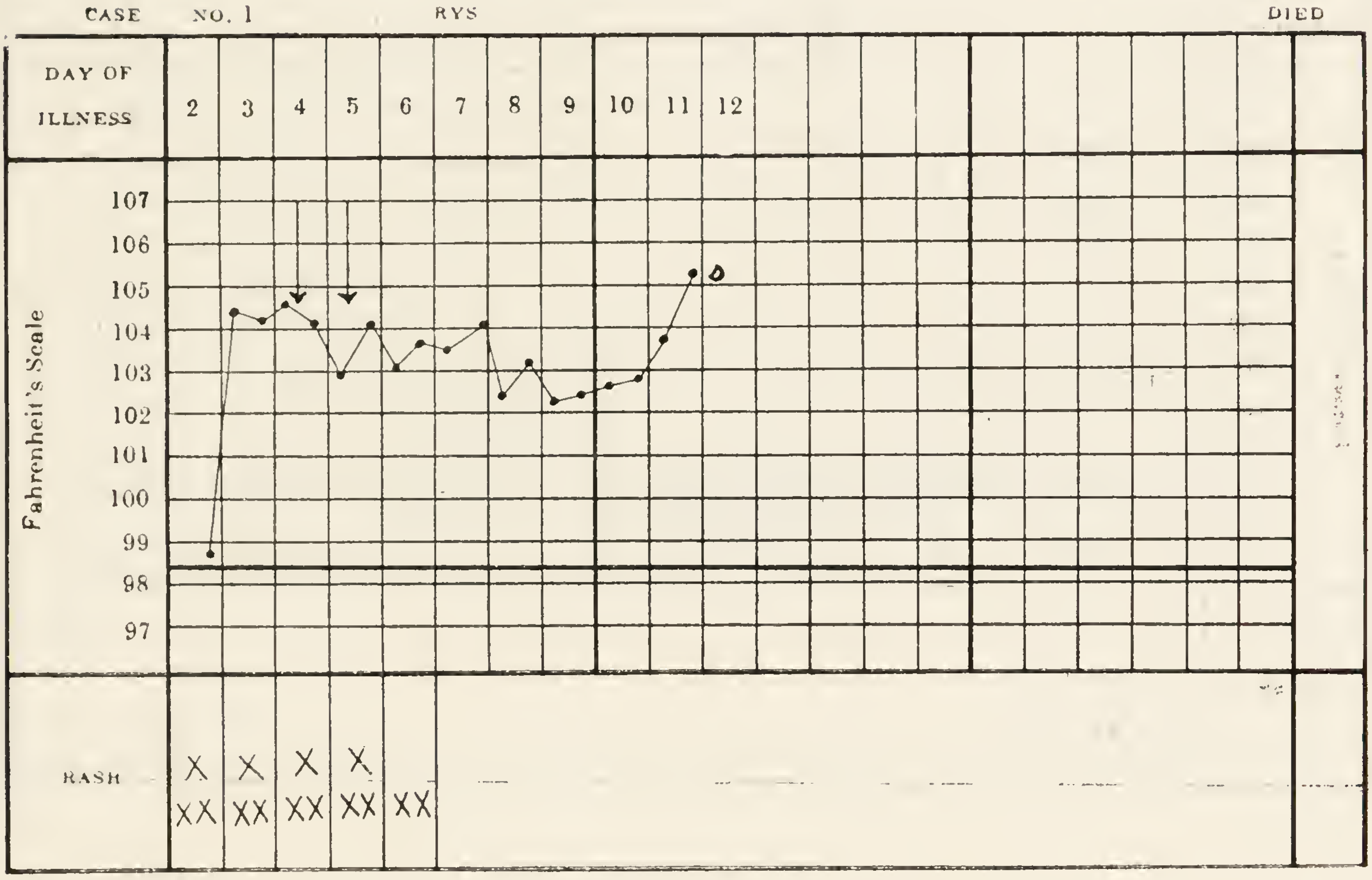
Case.	Sex	Age	Clinical condition	Day of Illness	Amount of Serum	Serum	Result	Complications
1. Rys	m.	1½	Severe	4th and 5th	20 and 20 c. c.	Dicks' conc.	Died 7 days	Adenitis
2. Br	f.	6	,,	2d	40 c. c.	Dochez's unconc.	Recovered 5 days	Serum sickness
3. Kus	m.	11	Moderate	2d	40 c. c.	Dochez's unconc.	Recovered 36 hours	
4. Los	f.	7	Severe	8th	20 c. c.	Dicks' conc.	Recovered 60 hours	Otitis media
5. Bar	m.	7	,,	3rd	40 c. c.	Dochez's unconc.	Recovered 11 days	Albuminuria Adenitis
6. Zal	f.	11	Moderate	5th and 6th	10 and 20 c. c.	Dicks' conc.	Recovered 9 days	Slight nephritis Rheumatism
7. Kur	f.	6	,,	4th	20 c. c.	Dochez's conc.	Recovered 72 hours	
8. Sm	m.	5	Mild	4th	20 c. c.	Dochez's unconc.	Recovered 72 hours	Adenitis

TABLE II. SUMMARY OF CHINESE SCARLET FEVER PATIENTS TREATED INTRAMUSCULARLY WITH ANTITOXIN.

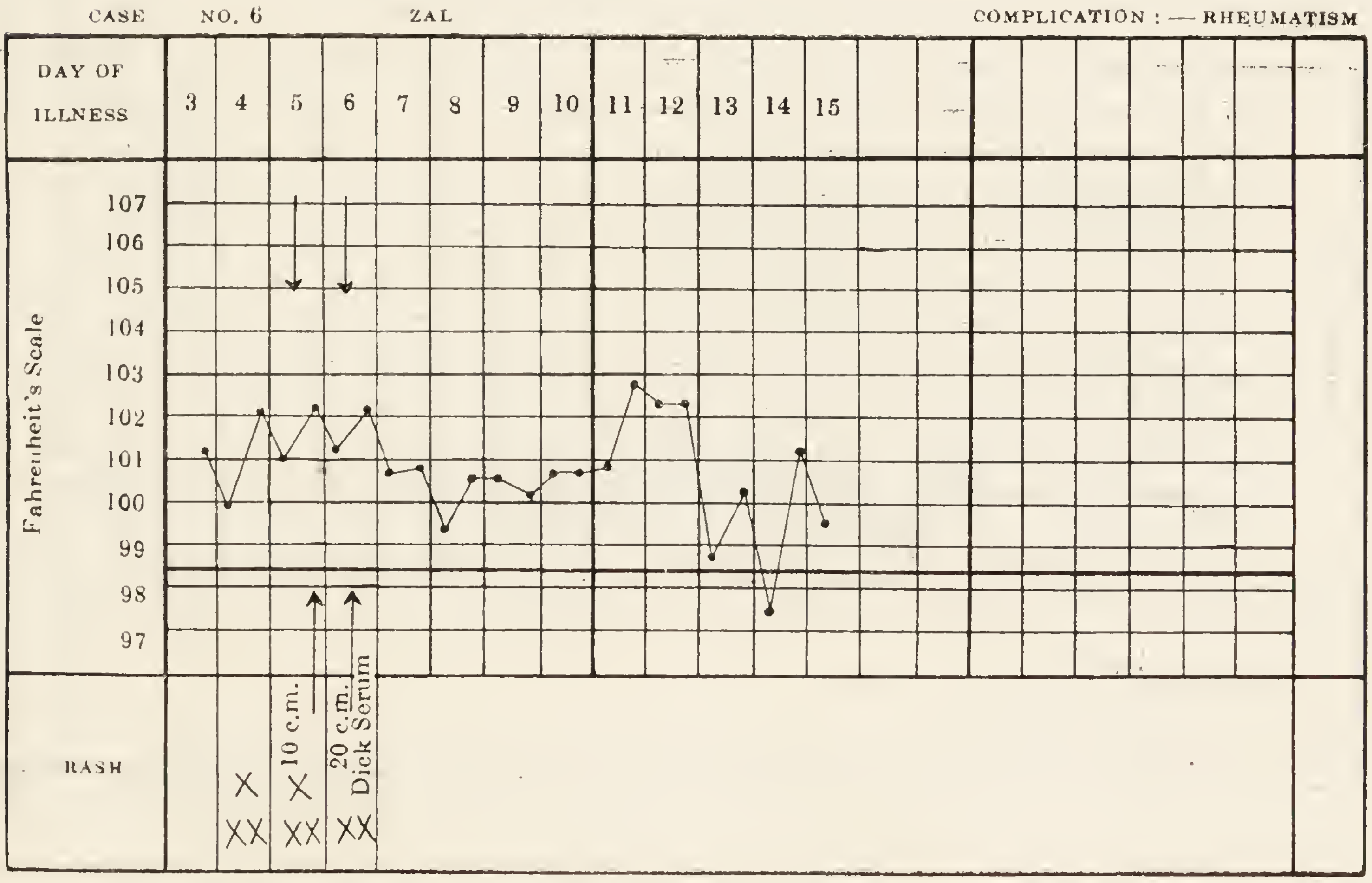
Case.	Sex	Age	Clinical condition	Day of Illness	Amount of Serum	Serum	Result	Complications
1. Han	m.	5	Very toxic	3d	10 c. c.	Dicks' conc.	Died 24 hours	
2. Li	m.	27	,,	3rd and 4th	20 c. c. Intramusc. 20 c. c. Intravenous	Dochez's unconc. Dochez's unconc.	Died 4 days	
3. Li	m.	10	,,	5th	30 c. c.	Dochez's unconc.	Died 2 days	
4. Li	f.	4	,,	4th	20 c. c.	Dochez's unconc.	Died 12 days	
5. Jen	m.	4	Moderately severe	3d	20 c. c.	Dochez's unconc.	Died 7 days	Cellulitis neck
6. Li	f.	3	Mild	3d	10 c. c.	Dochez's unconc.	Died 7 days	
7. Li	m.	7	Moderately severe	5th	10 c. c.	Dochez's unconc.	Recovered after 2 days	

CHARTS OF SCARLET FEVER CASES.

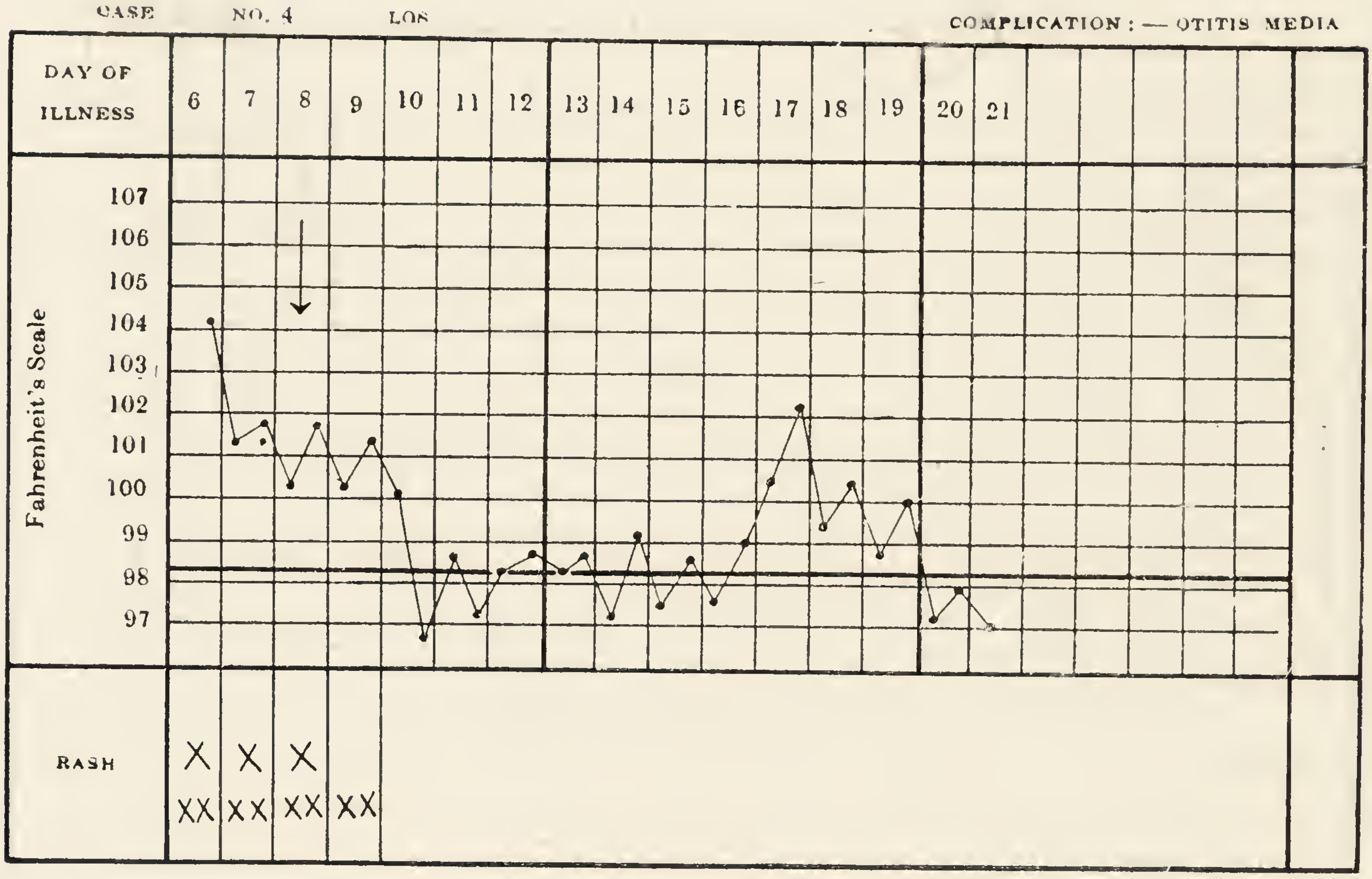
CASE NO. 1 RYS DIED



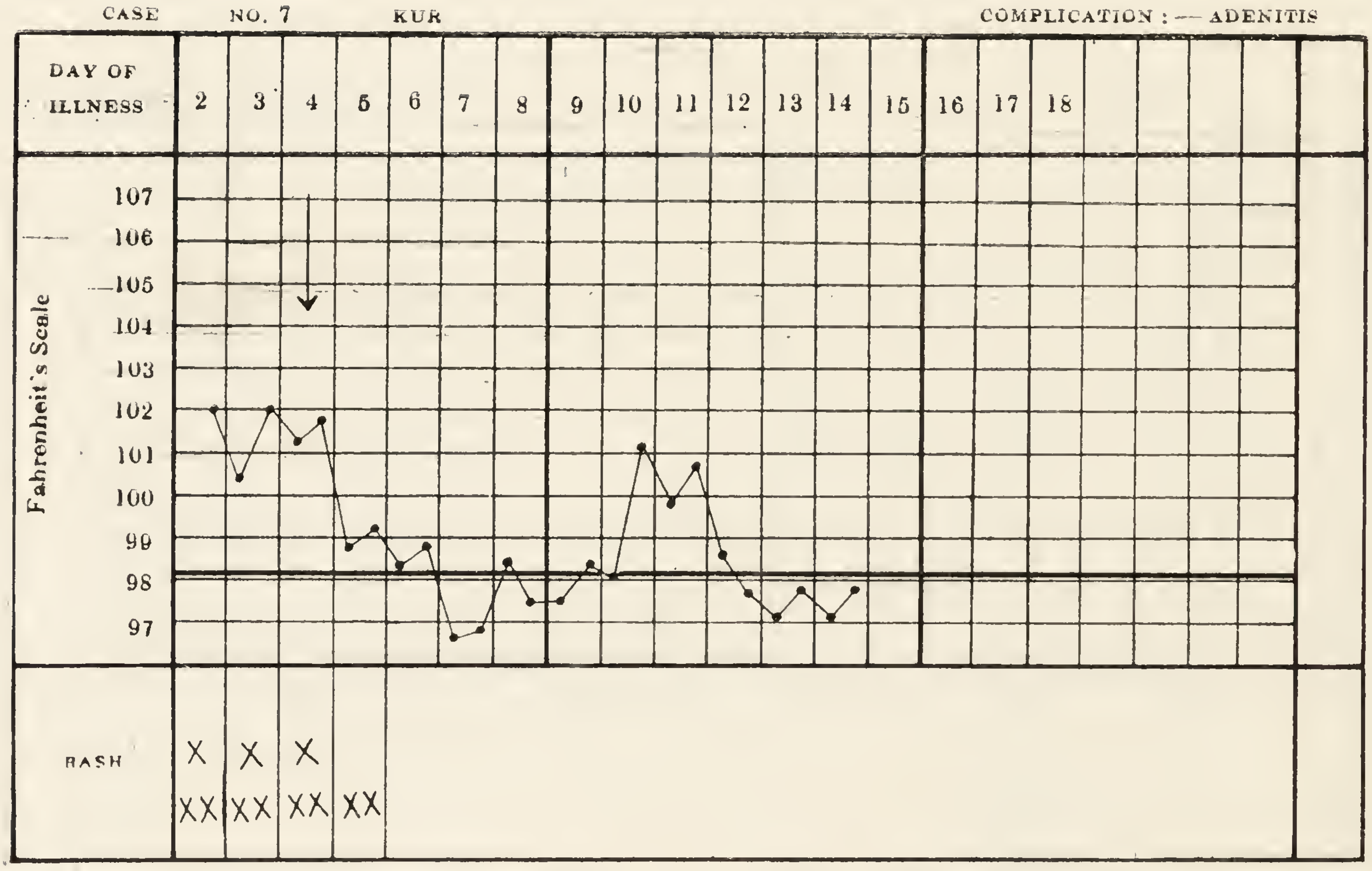
CASE NO. 6 ZAL COMPLICATION : — RHEUMATISM

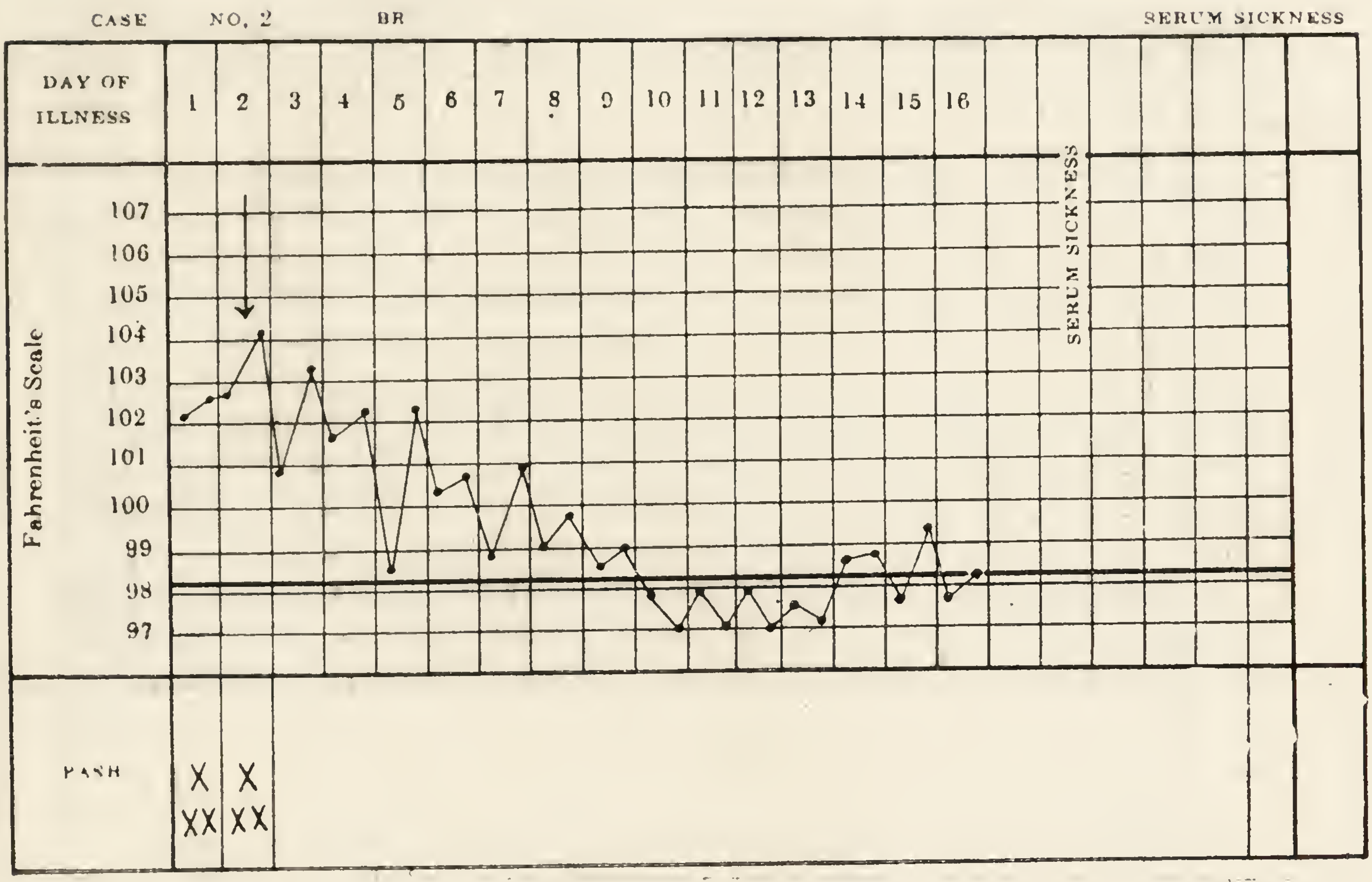


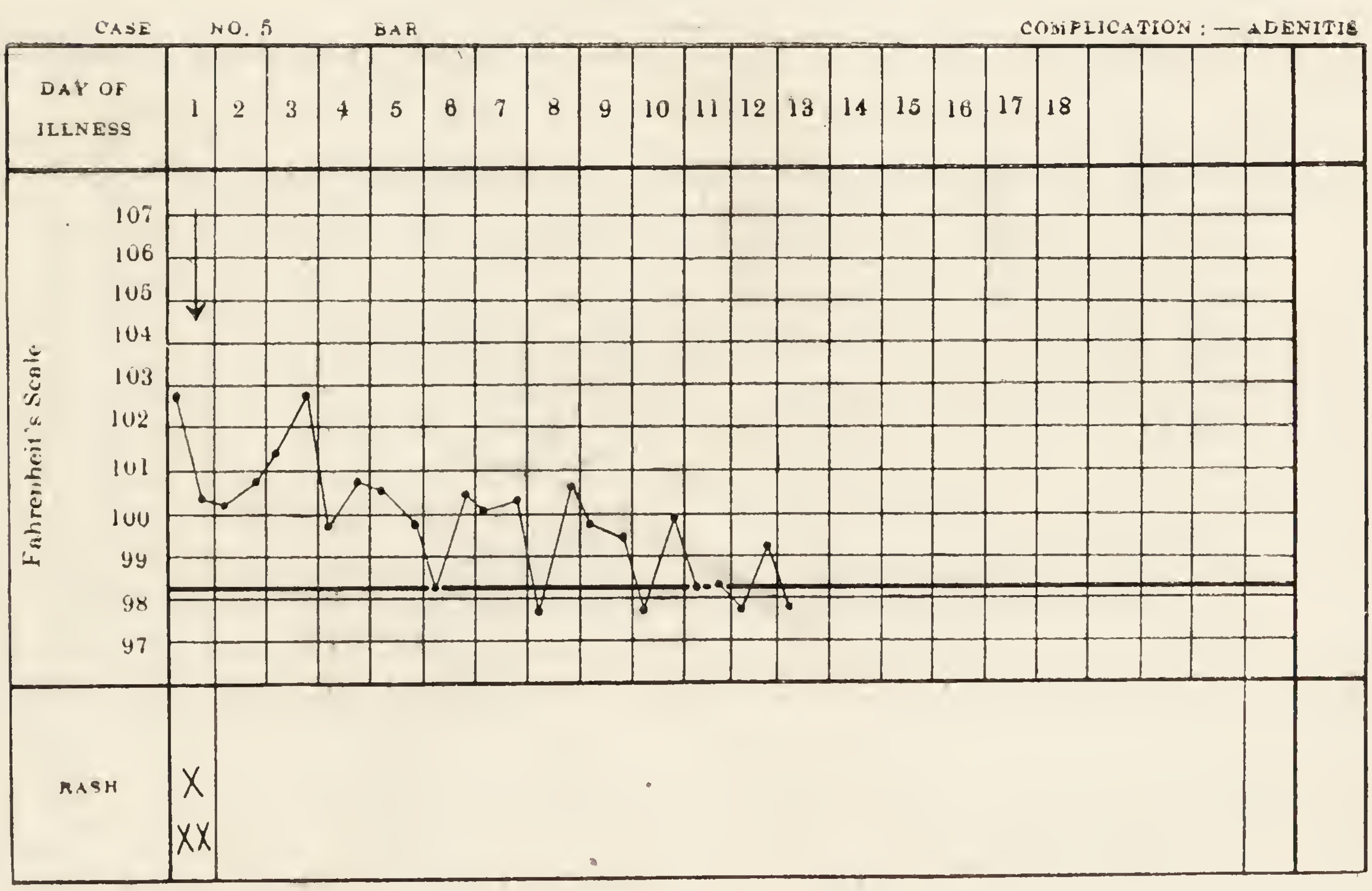
CASE NO. 4 LOS COMPLICATION : — OTITIS MEDIA

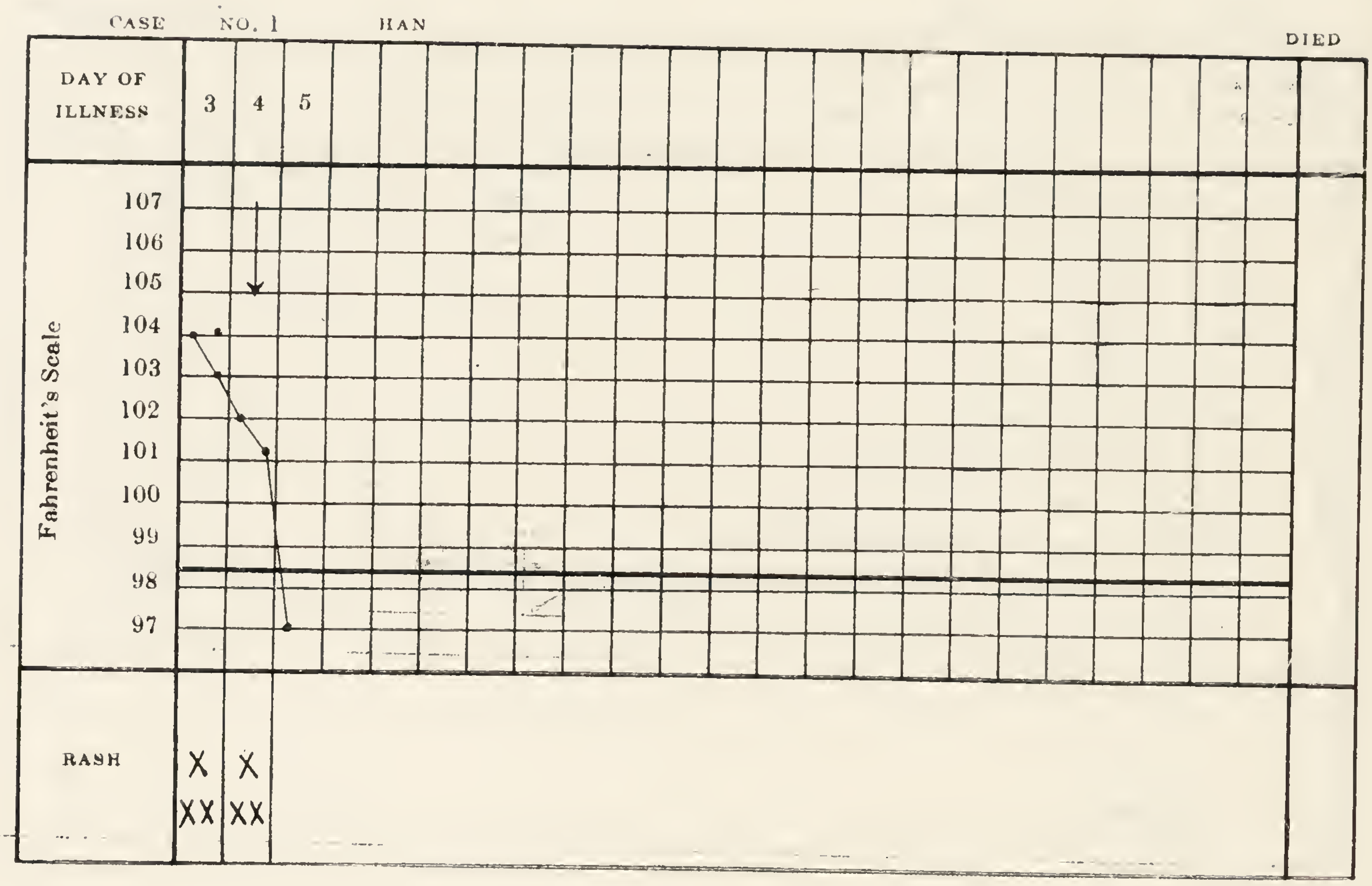


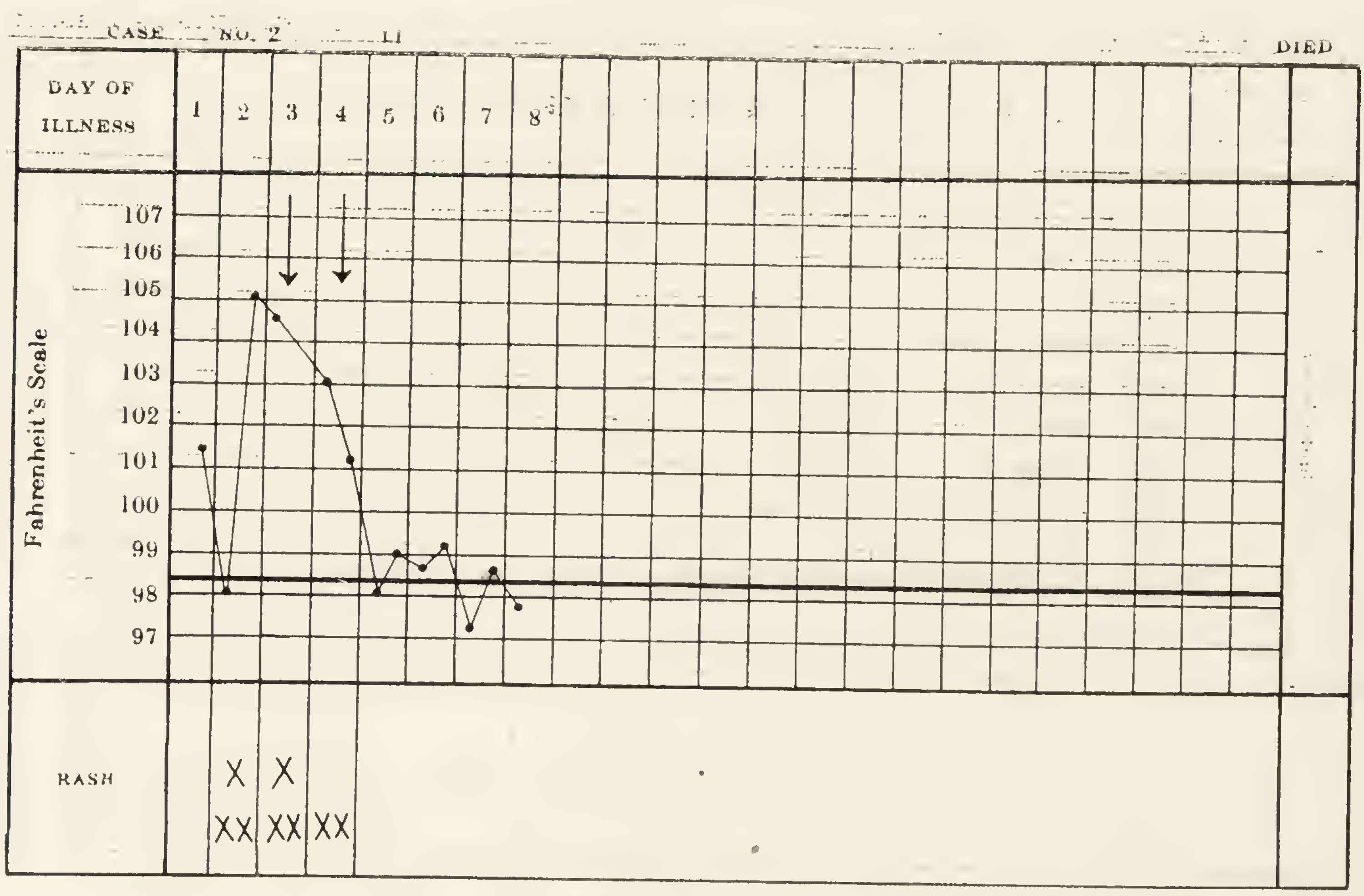
CASE NO. 7 KUR COMPLICATION : — ADENITIS




CASE NO. 2 BR
SERUM SICKNESS
DAY OF ILLNESS
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
Fahrenheit's Scale
107
106
105
104
103
102
101
100
99
98
97
SERUM SICKNESS
RASH
X X
XX XX


CASE NO. 5 BAR
COMPLICATION : — ADENITIS
DAY OF ILLNESS
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18
Fahrenheit's Scale
107
106
105
104
103
102
101
100
99
98
97
RASH
X
XX


CASE NO. 1
HAN
DIED
DAY OF ILLNESS
3
4
5
Fahrenheit's Scale
107
106
105
104
103
102
101
100
99
98
97
RASH
X
X
XX
XX


CASE NO. 2
LI
DIED
DAY OF ILLNESS
1
2
3
4
5
6
7
8
Fahrenheit's Scale
107
106
105
104
103
102
101
100
99
98
97
RASH
X
X
XX
XX
XX

The serum was fresh and it may be conceded that sufficient doses have been given, for in 4 patients, 2 therapeutic doses were injected, in 1 patient 1½ dose, and in the remainder (3 patients) 1 therapeutic dose.

In 2 patients, the serum was given on the 2d day of illness and in 1 patient on the 3d day.

There were 4 severe cases, the criterion being a temperature over 102°F. and symptoms of toxæmia.

Turning to the temperature charts, those for cases Nos. 3 and 8 have not been put down, because the patients recovered rapidly and uneventfully, though not so characteristically as described by American workers who have reported on their experience with anti-toxin. Chart for No. 1 shows that the illness was hardly influenced by anti-toxin, though the rash disappeared 48 hours after the second dose. But the patient became weaker and more toxic and died on the 12th day of illness.

This patient's clinical history may be shortly reviewed:

Aug. 9 Suddenly ill with vomiting, fever, and sore throat.

10 Rash on abdomen.

11 Temp., 104.5° F.; rash all over body. Marked œdema of throat and tonsils. Punctiform yellow exudate on tonsils. Cervical glands considerably enlarged. Lungs, liver, and spleen normal. Heart sounds somewhat dull.

12 Unchanged, 20 c. c. Dicks' conc. serum injected.

13 Unchanged, 20 c. c. Dicks' conc. serum again injected.

14 Œdema of throat diminished. Cervical glands more enlarged. Temp., 103.6° F.

15 Rash faded. Temp., 104.1° F. Pulse 166, weak and easily compressible.

16 Spasms in limb muscles. Temp., 103.1° F. Patient very apathetic.

17 Cervical glands less swollen. Cardiac sounds dull, systolic murmur heard at apex. Pulse dicrotic, very frequent and soft. Rhonchi are heard here and there in lungs.

18 No change.

19 Pulse very feeble. Muscular spasms appeared again. Abundant rhonchi in lungs. Death occurred at 9:30 p.m.

Temperature charts for cases Nos. 4, 6, and 7 show rapid recovery, but the fever rises again, owing to complications.

Temperature charts for cases Nos. 2 and 5 suggest septic fever with evening rise, followed by slow recovery after several days.

It may be noted that the rash seems to disappear soon after the anti-toxin administration in all the cases.

Table II presents a disappointing picture, for out of 7 cases treated with anti-toxin, there were 6 deaths (85.7%).

Cases Nos. 1 and 4 were too ill to be benefited by any line of treatment, but No. 6, Li, was a mild case at the time of injection, and yet she died after 7 days. Since the child was small, being 3 years of age, and with the objection of the parents, only half a therapeutic dose was given.

With regard to case No. 2, Li, the clinical history may be interesting.

Dec. 2 He was admitted into our hospital for excision of a small T. B. gland of neck.

Physical examination showed nothing abnormal. Patient was a healthy young man of 27.

3 Operation was performed under local anæsthesia.

7 Suddenly ill in morning, with vomiting, diarrhœa. Temp., 101.4° F., and pulse, 116.

Temp., 105° F. Very ill. Can hardly stand. Rash appeared on trunk. Throat swollen and red. Cervical glands somewhat enlarged.

9 Rash all over the body. Very ill. Pulse, 120, weak. 20 c. c. anti-toxin injected intramuscularly.

10 Temperature a little lower. Pulse still weak. 20 c. c. anti-toxin injected intravenously.

11 Temp. fell to normal, but patient was more or less delirious. Pulse 120. Rash disappeared. Heart stimulants given.

12 No change. Camphor injections given.

14 Patient became weaker and died on 14th morning.

Looking at the temperature charts for cases Nos. 1 and 2, the anti-toxin seems to have a powerful effect on the fever and the rash. The fact that four patients showed temporary improvement and only died after several days may suggest that either the anti-toxin was injected too late or in too small quantities, so that the scarlet fever toxin had already wrought irreparable damage to the organism. Considering the cases, few as they are, the results cannot be said to be encouraging on the whole.

While no improvement due to serum treatment was to be seen among the Chinese patients who suffer usually from a virulent form, among the Russian patients some good effect may be traced to the anti-toxin administration, but even then there were 5 instances of complications. Most of the authors maintain that with the exhibition of scarlet fever Streptococcic anti-toxin, there is a sudden fall of temperature, a rapid fading of the rash and an improvement of the pulse. We only saw the rapid fall of temperature in one mild and one moderately severe case. In severe cases, the fall was only temporary. The cardiac condition was not improved. The only thing is that the rash seemed to fade somewhat quicker than usual, both in mild and severe cases.

We cannot say, then, that the results were so striking as reported by other authors. It may be that the anti-toxin is not effective because it was made in America from American strains and not from local strains of Streptococcus hæmolyticus. This opinion is supported to a certain extent by good results of the treatment of 3 severe cases of scarlet fever by Chen[23] with anti-toxin made in Peking.

We are immunizing horses with Harbin strains of Streptococcus hæmolyticus from fatal cases of scarlet fever after the method of the Dicks as well as that of Dochez. When the serum is ready, we hope to treat a larger number of scarlet fever patients with it, and will report on the results, which we hope will be better than those we have tried to elucidate.

Finally, we desire to register our thanks to Dr. Korelkin, of the Harbin Municipal Hospital, for kind assistance and for permission to publish his notes.

REFERENCES.

1. Loeffler, *Arb. a.d.k. Gesundh*, 1884.
2. Marmorek, *Ann. Inst. Pasteur*, 1895, IX, 593.
3. Moser, *Wien Klin. Wchschr.*, 1901, XV, 1053.
4. Savchenko, *Russk Vrach*, 1905, No. 25, p. 797.
5. *Centralbl. f. Bakteriol*, 1, Orig. 41.
6. Polotevkova, *Russk Vrach*, 11 : 1183, 1921.
7. Bliss, *W. P. Journ. Exp. Med.*, XXXVI, 575, 1922.
8. Tunnicliffe, *Jl. Am. Med. Assoc.*, LXXIV, 1386, 1920.
9. Stevens, *Proc. Exper. Biol. & Med.*, XXI, 39, 1923.
10. Gordon, *Brit. Med. Jl.*, T. 632, 1921.
11. Dochez & Sherman, *Jl. Am. Med. Assoc.*, LXXXII, 542, 1924.
12. Dochez, *Proc. Exper. Biol. & Med.*, XXI, 184, 1924.
13. Blake, Trask & Lynch, *Jl. Am. Med. Assoc.*, LXXXII, 712, 1924.
14. Birkhaug, *Bull. John Hopkins Hosp.*, Vol. XXXVI, No. 2, Feb., 1925.
15. Park, *Jl. Am. Med. Assoc.*, Vol. 85, No. 16, Oct. 17, 1925.

16. Dick & Dick, *Jl. Am. Med. Assoc.*, Jan. 26, 1924, Vol. 2, pp. 301, 302.

17. Dick & Dick, *Ann. Clin. Med.*, Vol. III, No. 8, Feb., 1925.

18. Dick & Dick, *Jl. Am. Med. Assoc.*, Sept. 3, 1921, Vol. 77, pp. 782-785.

19. Dick & Dick, *Jl. Am. Med. Assoc.*, Oct. 6, 1923, Vol. 81, pp. 1166-1167.

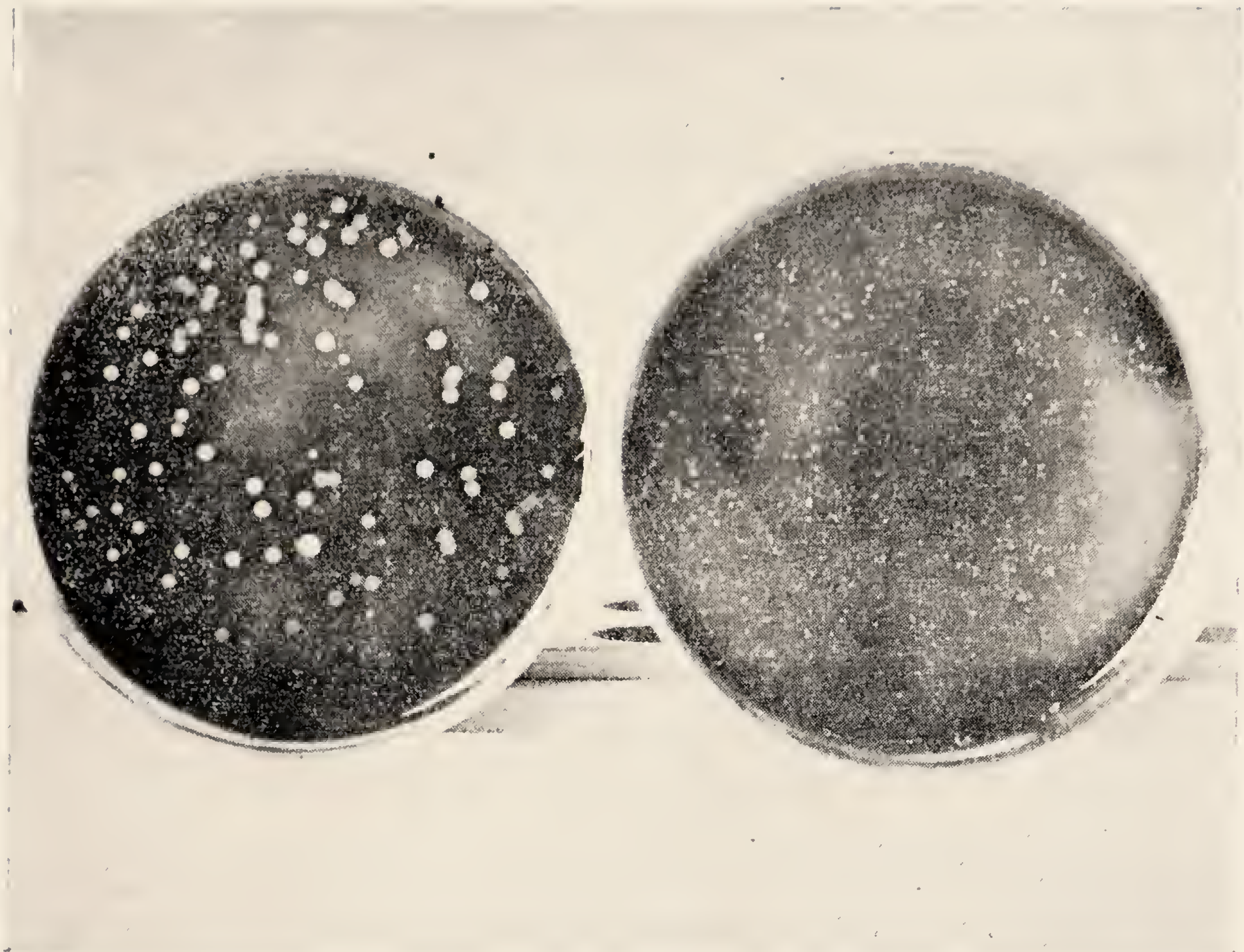
20. Dick & Dick, *Jl. Am. Med. Assoc.*, Jan. 26, 1924, Vol. 82, pp. 301, 302.

21. Dick & Dick, *Jl. Am. Med. Assoc.*, April 19, 1924, Vol. 82, pp. 1246, 1247.
Dick & Dick, *Jl. Am. Med. Assoc.*, March 14, 1925, Vol. 84, pp. 803-805.
Dick & Dick, *Jl. Am. Med. Assoc.*, Nov. 28, 1925, Vol. 85, pp. 1695-1697.

22. Yang & Shih, *Nat. Med. Jl.*, June, 1924, Vol. X, No. 3, p. 153.

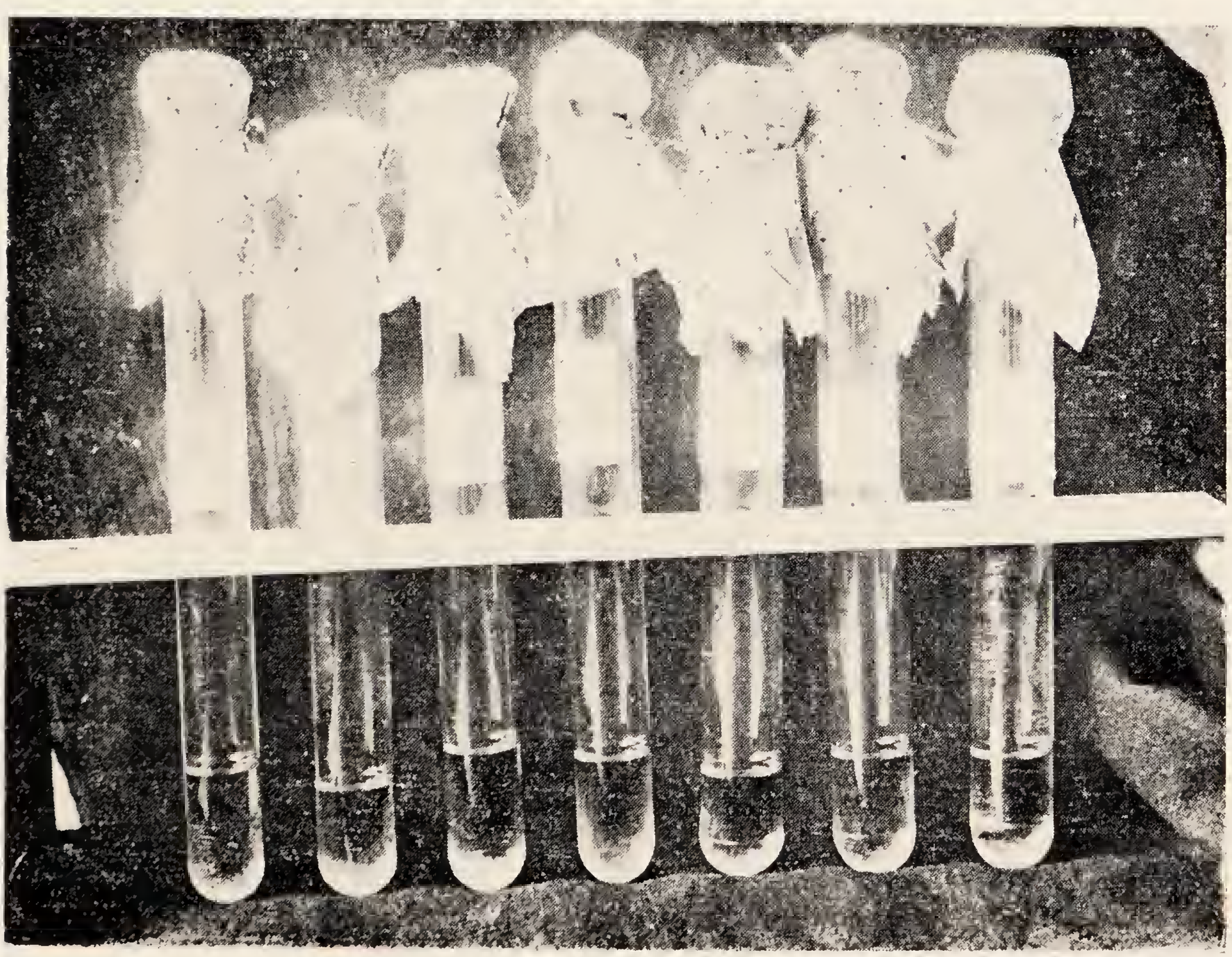
23. Chen, *China Med. Jl.*, Oct., 1925, Vol. XXXIX, No. 10, p. 911.

J. W. H. Chun, m.b.
H. M. Jettmar, m.d.



Agar Plates showing growths of Streptococcus Haemolyticus, always recoverable from the throats of scarlet fever patients.

溶血性連球菌在海菜培養現象此菌在猩紅熱病人咽部常見



Clusters of Streptoccus Haemolyticus seen at the bottom of tubes of bouillon.

溶血連球菌聚集在肉汁培養管底現象

RESULTS OF THE DICK TEST IN HARBIN.

Paper read at the Peking Conference 1926 of the China Med. Assoc.

TABLE OF CONTENTS.

1. INTRODUCTION.

In 1923 Dr. Dick and Mrs. Dick succeeded in producing scarlet fever in human volunteers by inoculating a hæmolytic streptococcus obtained from a case of scarlet fever. Next year they described a skin test for susceptibility to scarlet fever comparable to the Schick test for diphtheria. This reaction, being tested by A. Zingher and C. F. Branch and F. G. Edwards, has been confirmed. In July 1924 Okell and Baxter reported a number of tests. Ker, McCartney and McGarity (1925) have reported a further series of tests done on scarlet fever patients and on normal individuals. In April 1925 Okell and H. T. Parish further reported upon the Dick test as well as a clinical study.

Very little was done in China until 1925 when Dr. Wu Lien Teh brought from America some original strains of the American streptococcus as well as a few bottles of standard toxin and anti-toxin from the Dicks and encouraged us to carry on this research. Unfortunately the original Dick's strain was found to be somewhat weak in toxicity as well as the standard toxin. We therefore used fresh cultures obtained from the throats of severe scarlet fever patients.

2. PREPARATION OF THE DICK TOXIN.

To 5 pounds of lean fresh meat cut up with a meat chopper, 300 c. c. water ware added and boiled for two hours. Loss by evaporation is made up with distilled water, 15 grms. sodium chloride and 45 grms. peptone are dissolved and slightly over-neutralised with a solution of potassium hydrate until alkaline to litmus paper; then to every 100 grms. broth O.1 sod. carbonate is added and boiled. After replacing the evaporated water, it is filtered, divided into 100 ccm. or 200 ccm. each and sterilised.

Flasks containing 100 or 200 ccm. broth mixed with 1 or 2 ccm. defibrinated human blood are incubated for two days to test for sterility. These are then inoculated with suspension of special streptococcus hæmolyticus and incubated for 5 days at 36-37° C. Every day the flasks are shaken thoroughly, then films are made from each broth culture to ensure that a pure culture of hæmolytic streptococcus is present.

The pure broth culture is filtered through filter paper (Schleicher Schuell). The clear filtrate is passed through a Berkefeld "N" and later through a Berkefeld "W". The filtrate, being tested again for sterility, is put in flasks, standardised and titrated according to Dick's original method.

DILUTION AND OBSERVATION.

A dilution of approximately 1 : 2,000 to 1 : 1,000 varying in accordance with the strength of the filtrates was employed in doses of 0.1 ccm., and the reaction within 24 hours observed.

Areas of redness measuring 1.0 cm. or more in diameter are interpreted as positive. The positive reaction develops in from six to twelve hours as a bright red flush with average diameter of 20 mm. by 30 mm. So that reading is better made of the reaction earlier than 24 hours.

TABLE I. DICK TEST ON INDIVIDUALS NOT SUFFERING FROM SCARLET FEVER.

Age Period in years.	No. tested.	Negative.	Positive.	Positive percentage.
1-3	6	1	5	83.3
3-4	5	0	5	100.0
4-5	10	0	10	100.0
5-6	8	2	6	75.0
6-7	25	1	24	96.0
7-8	18	9	9	50.0
8-9	14	1	13	92.0
9-10	18	12	6	32.0
10-15	158	85	73	43.3
15-20	267	115	152	56.9
20-25	196	107	89	45.4
25-30	165	95	70	41.2
30-35	138	89	49	35.5
35-40	91	63	28	30.7
40-45	57	32	15	26.3
45-50	25	16	9	35.1
Total	1201	638	563	46.8%

Table I shows the results of Dick tests made upon individuals not suffering from scarlet fever; here the positive rate is higher than that given by Zingher for New York and also that by Silcock for Leicester and Alexander Joe for Edinburgh.

Zingher (New York) gives the number Dick positive for all ages as 34.4%, Whistler gives 51.5% for Edinburgh, Nesbit gives 50% in Garry School Indiana, U.S.A., and Okell gives 74% in London.

The following table shows the comparative figures :—

TABLE II. PERCENTAGE DICK—POSITIVE IN—

Leicester.	New York (Zingher).	London (Okell).	Garry (Ind.) (Nesbit).	Edinburgh.	Harbin
47.7	34.4	74.0	50.0	51.5	46.8

It is obvious, as Park has pointed out, that if a toxin is a little too strong it will give a higher percentage; if it is too weak there is a possibility of having people who are susceptible pronounced as immune or insusceptible. But on the most susceptible age—group (1-2 years) Zingher found as high as 70%, McGarrity and McCartney found their highest positive percentage to be 67.8 in the 2-3 age-group. According to my figures it would appear that the greatest susceptibility lies between 1-9 years.

My table I comprises 970 males and 231 females. The percentage does not seem to vary with sex. Of the persons included in table I, 42 gave a previous history of scarlet fever; of these only eight (19%) gave positive reactions and 80.9% negative.

Even though the histories are not always accurate, the test would appear to be largely negative for these persons giving a history of scarlet fever.

TABLE II. DICK TEST IN SCARLET FEVER PATIENTS.

Day of Disease.	No. tested.	Positive.	Negative.	Positive %
1-5	21	19	2	90.5
6-10	25	20	5	80.0
11-15	25	15	10	60.0
16-20	28	9	19	32.0
21-25	20	2	18	10.0
26-30	18	1	17	5.5
Over 6 weeks ...	30	1	29	3.3
Total	167	67	100	41.1

From the above we gather that out of 167 tests in scarlet fever patients 40.1 percentage was positive (in many cases the test was made on the same patients at different stages of the disease).

I have collected only 34 cases which were tested on two three or four occasions and all gave positive reactions in the early stages but later became negative. A percentage of 90.5% positive in the first five days of fever was recorded but this diminished gradually.

J. E. Mc. Cartney and J. Mc. Garrity found that 73 per cent. of the patients in the first three days of fever gave positive reactions.

Dr. Zingher reported 100% positive in the early stage, Alexander 95%, Silcock 68%. These no doubt depend upon the intensity of toxin but anyhow a positive Dick test is found in a high percentage in early stages of scarlet fever, declining gradually with the progress of disease.

5. ACTIVE IMMUNITY WITH TOXIN.

For this purpose we have prepared toxin in 100, 500, 1,000 and 2,000 skin doses and made injections with 100-1,000 skin doses at five days interval on about 200 normal individuals. Unfortunately children who are so susceptible to scarlet fever were too few. Not one child inoculated in 1925 has reported sickness, although scarlet fever has occurred sporadically throughout the last 12 months in Harbin.

On the question of active immunity an experiment was made to see how many skin doses were required in order to obtain a negative Dick.

Four inpatients all strongly positive were chosen of whom two were injected with 100 to 2,000 skin doses on every five days and repeated 3 times more with 2,000 skin doses. In one altogether ten 600 skin doses were given and then the Dick test began to turn negative in a month. In the other two 100, 500, 1,000 and 3 times of 2,000 were required also to make the Dick test negative.

6. CONCLUSIONS.

(1) In 1201 persons not suffering from scarlet fever 46 percent showed positive Dick reactions; of these 42 gave a history of scarlet fever and among them only eight (19%) gave positive reactions.

970 males and 231 females were tested, the reaction apparently not being influenced by sex.

The most susceptible age period in Harbin appeared to be 1-9 years.

(2) The Dick test in the first five days of disease yielded a positive percentage of 91.5%, which diminished gradually with the progress of the disease.

(3) Regarding active immunity, out of four strongly positive persons 10,000 skin doses on the average were needed to make the Dick test negative, this being obtained after one month.

---

1. Dick G. F., and Dick Gladys H. : Jl. Amer. Med. Ass. Oct. 6th, 1923.
2. Dick B. F., Dick and Dick G. H. : Jour. Amer. Med. Ass. Jan. 24th. 1924.
3. Branch C. F. and Edwards F. G. ; Jl. Amer. Med. Ass. April 19th, 1924.
4. A clinical study of the Dick test by Alexander, Edinburgh ; Dec. 26, 1925, 1321 Lancet V. II.
5. The Dick test at a Fever Hospital by Silcock : The Lancet Dec 26. 1925. p. 1324.
6. Ker, C. B. and colleagues : The Lancet 1925, i. 230.
7. Zingher A. ; Jour. Amer. Med. Ass. August 5th. 1924, p. 432.
8. Okell C. C. : The Lancet 1925 i. p. 712.

S. B. CHOW, M.D.
(*Asst. Med. Off. Harbin.*)

ON THE BEHAVIOUR OF THE HAEMOLYTIC SCARLET FEVER STREPTOCOCCI IN THE BODIES OF REPTILES AND AMPHIBIANS.

While the behaviour of the streptococci pathogenic for man in the body of animals has been studied on a great number of different mammals, but little work has been performed in regard to their action upon *lower* vertebrates.

Inasmuch as, owing to numerous studies of American authors, great attention is paid at present to the scarlet fever streptococci and they are easily obtained in pure culture, such strains were used for experiments in this direction.

We used solely haemolytic streptococci which had been recently isolated from the fauces of patients because it did not seem advisable to influence these microorganisms, which are rather sensitive in their antigenic properties, through subculturing.

As test animals we used (i) Non-poisonous vipers from Anda near Harbin and (ii) big green water-frogs from the Sungari marshes.

A. EXPERIMENTS WITH VIPERS.

(*a*) On July 17, 1926, two vipers were inoculated subcutaneously in the middle part of the trunk with 1 c.c. of a bouillon emulsion of a strept. haemol. strain, isolated a few days previously from a highly toxic scarlet fever case (cultivation from fauces 10 hours before death). The vipers were kept partly in the incubator at 32° C., partly at room temperature; they were together with 2 control animals.

On July 20 the two infected vipers looked somewhat lazy, apparently ill. If turned on their backs they remained for a considerable time in this position while the control animals quickly resumed their normal position. The two vipers were killed on the next day (21st). Internal organs showed no marked changes. Three recently prepared rabbit blood-agar dishes are respectively inoculated with material taken under sterile precautions from the site of infection.

Results taken on July 22 were as follows :
Dishes from viper No. I sterile.

Dishes from viper II show haemolytic streptococci in pure culture; more isolated colonies show areas of resorption 1.6 to 2.4 mm. wide. No greenish colonies.

(*b*) On July 22 a viper received *intramuscularly* an emulsion from a whole blood-agar dish which had been inoculated 24 hours before with a highly toxic scarlet streptococcus strain and showed plentiful growth. The animal together with a control was kept at room temperature.

Five days after infection with this large amount of bacteria the inoculated animal had completely recovered and remained afterwards well and agile.

From these experiments it may be tentatively concluded :

1. That snakes receiving highly virulent scarlet fever streptococci by injection show a passing disturbance of their health.

2. That in the subcutaneous tissue of the snakes this strain of streptococci may remain living and unchanged more than four days.

3. That snakes overcome such an infection, the streptococci finally succumbing.

B. EXPERIMENTS WITH BIG GREEN WATER-FROGS.

(*a*) Two series of 10 frogs captured the day before are inoculated in the *dorsal lymph sac,* those of the first series receiving 0.1-0.3 c.c. of pure toxin of scarlet fever streptococci (filtrate of a 5 days old bouillon culture), those of the second the centrifugate of an emulsion of virulent bacteria in physiologic salt solution. Each animal of this series receives the equivalent of 3-5 loops. 10 frogs are kept as third (control) series.

After 5 days the frogs inoculated with living streptococci, were found well and agile. They were then killed by decapitation and the blood from the neck was cultured upon rabbit blood-agar dishes.

Result : All dishes remained sterile, showing no colonies of Strept. haemolyticus.

The animals receiving strept. toxin all survived without showing any symptoms of illness.

(*b*) Five big frogs were each given *intraperitoneally* the whole sediment of a tube containing 10 c.c. of a recently prepared bouillon culture of scarlet fever streptococci.

After 3 hours frog No. I is killed, and smears are made from its peritoneal fluid. Result : Short chains of streptococci, frequently grouped together so as to resemble the arrangement of staphylococci (agglutination).

After 24 hours frog No. II is killed by decapitation; blood-agar dishes are inoculated with blood from the neck wound and the peritoneal liquid respectively. Result : Both agar dishes show typical streptococci in pure culture. On the dish sown with the blood the colonies are more numerous, stand closely and have run together at places forming large haemolytic plaques. On the dish from peritoneal liquid there are not more than 100 colonies.

After 36 hours frog No. III is killed and cultures are made as in case No. II. Smears from the peritoneal liquid show only a few short chains of streptococci; no phagocytosis.

Cultural results : On dish from blood, 2 colonies of Strept. haemol. were recovered. Dish from peritoneal liquid remains sterile.

After 48 hours frog No. IV is killed. Cultivations made as in foregoing cases. Microscopically in an agglomeration of bacteria from the peritoneal cavity chains of streptococci, mainly suspended in the liquid, partly phagocyted (clumped together) in the plasma of large cells; apparently those streptococci are severely damaged. In smears from the blood no streptococci seen.

Cultural results : Both dishes showed no streptococci.

The fifth infected frog was inoculated intraperitoneally four days after the first injection with the *whole centrifugate* of 60 c.c. streptococcus bouillon culture. The animal showed after the second dose passing symptoms of illness (laziness, loss of appetite). Five days after the last injection this frog was killed by decapitation. Both blood from the wound and the abundant clear peritoneal liquid were collected with pipettes and sown upon rabbit blood-agar dishes.

Post mortem of frog No. V. Big female animal. In the peritoneal cavity plenty of clear fluid. Omentum markedly thickened; some intestinal loops soldered together through thick, nodose, fibrin-like strands, rich in blood. Liver somewhat friable and discoloured. Lungs and other organs show no marked changes. Films from peritoneum and liver show very numerous streptococci, partly suspended, partly phagocyted, and more or less degenerated. The presence of small clumps of streptococci deserves mention.

Cultural results : Dishes cultivated from blood remained sterile. Most of the dishes inoculated with peritoneal liquid were quickly overgrown by short, haemolytic bacilli. Only dish No. IV, where this growth was less dense, showed on the margin single isolated colonies of Strept. haemol.

The following conclusions may be gathered from these experiments performed upon frogs :

1. Inoculation of comparatively small quantities of virulent streptococci causes no marked symptoms.
2. Streptococci injected in moderate quantities may be demonstrated by cultivation up to two days, whereas 5 days after inoculation they apparently became killed in the body of the frog.
3. Before the streptococci succumb, apparently on the first day, they become weakened and much reduced in number. This is seemingly caused by an agglutination process, while phagocytic phenomena play a less important role.
4. Haemolytic streptococci isolated at various times from the frogs showed normal cultural properties and had not lost their haemolytic faculties.
5. Considerable amounts of concentrated toxin of scarlet-fever streptococci are tolerated by the frogs without causing any symptoms.

C. S. LIN, (Harbin),

E. B. YOUNG, (Newchwang).

REPORT OF A PRELIMINARY HEALTH SURVEY OF PINCHIANG (CHINESE CITY OF HARBIN).

(JANUARY-JUNE, 1926.)

Introductory Remarks.

Part I.

1. General description of city.
2. Climate.
3. Mercantile notes
4. Educational institutions, etc.
5. Population of Pinchiang.

Part II. Existing Sanitary Organisations.

6. Main activities.
7. House and Street cleaning.
8. Water supplies.
9. Markets.
10. Disposal of refuse. Latrines.
11. Bath houses.
12. Charity Hospitals.
13. Infectious diseases. Isolation hospitals.
14. Cemeteries. Burial laws.

Part III. New Public Health Activities.

15. Health center in Pinchiang.
16. Scope of work.
    - i. Housing and living conditions.
    - ii. Prostitution.
    - iii. Restaurants and eating houses.
    - iv. Barber shops.
    - v. Hotels, lodging houses and inns.
17. Registration of practitioners, midwives and dentists.
18. Supervision of private hospitals and drug shops.
19. Health propaganda.
20. Special investigations.
    - i. Bacteriological examination of wells.
    - ii. Examination of stools.
    - iii. Physical examination of school children.
    - iv. Physical examination of infants.
    - v. Dick tests on 1275 inhabitants.
    - vi. Dick tests in 6 schools.

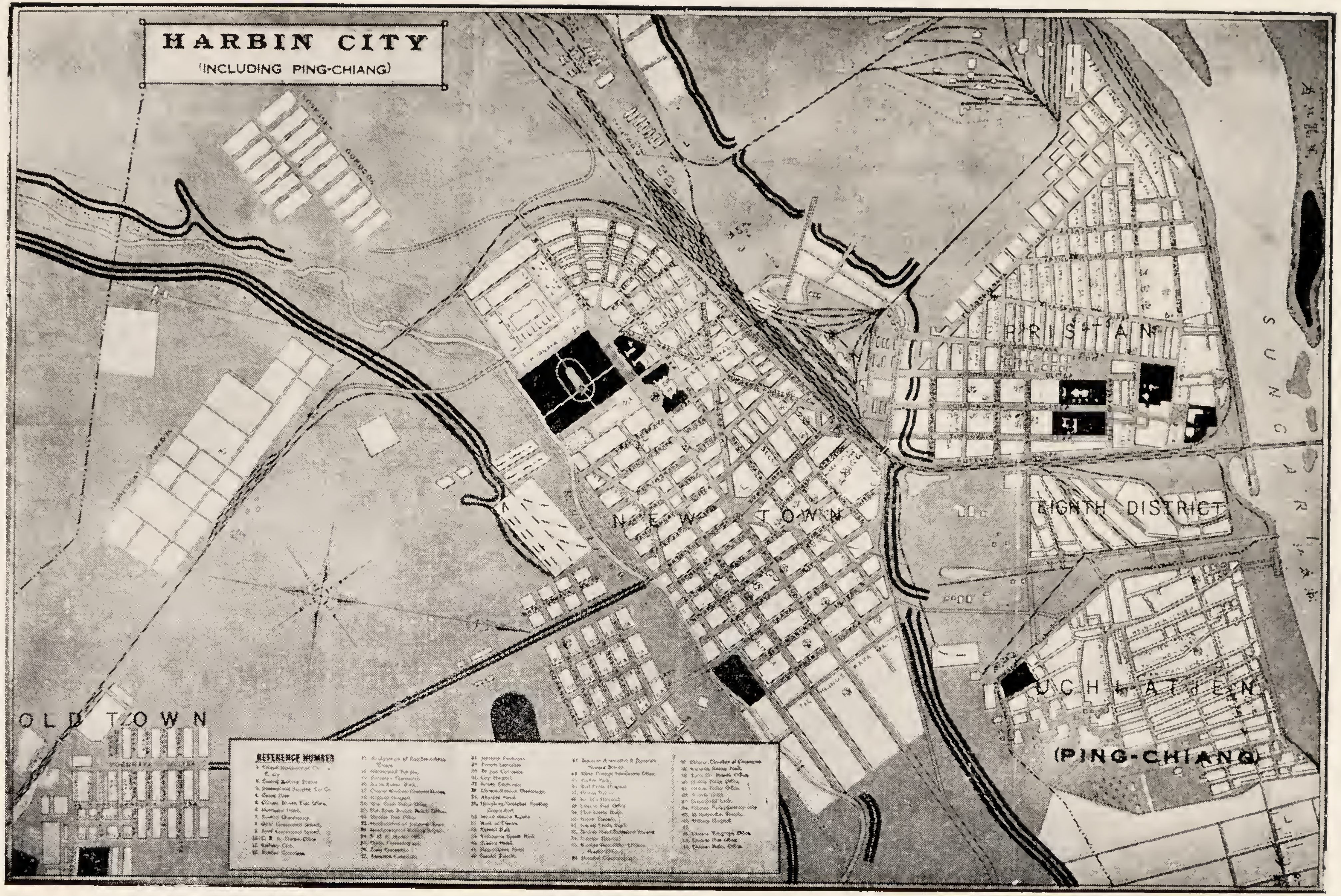
21. Statistics of communicable diseases.
22. Preliminary vital statistics.
23. Laboratory and Museum.
24. Summary and conclusions.

INTRODUCTORY REMARKS.

In a Report on Municipal Health Practice published by the American Public Health Association, 1923, there is an article by Drs. C. E. A. Winslow and H. I. Harris (Yale School of Medicine) on an ideal Health Department for a city of 100,000 population. In this Department 8 bureaux are recommended :

Bureau and division :	Estimated Budget (G.$) : Salaries :	Maintenance :	Total :
1. Bureau of administration :			
(*a*) Division of administration.	10500	2500	13000
(*b*) Division of public health education	1800	2000	3800
2. Bureau of Sanitation	10500	1000	11500
3. Bureau of foods :			
(*a*) Division of milk	4500	1000	5500
(*b*) Division of foods	4500	600	5100
4. Bureau of communicable diseases :			
(*a*) Division of epidemiology.	6800	2000	8800
(*b*) Division of tuberculous disease	6400	1500	7900
(*c*) Division of venereal diseases	6400	2500	8900
5. Bureau of child hygiene :			
(*a*) Division of infant hygiene (including the preschool age)	9000	1500	10500
(*b*) Division of school hygiene	20500	2000	22500
6. Bureau of nursing	77350	5950	83300
7. Bureau of laboratories	7750	2000	9750
8. Bureau of vital statistics	4000	500	4500
Total G.$	170000	25050	195050

American practice in Public Health seems to have followed as closely as possible the recommendations set out in that Report and large sums of money have been spent or earmarked by the different States and cities of the Union to reach the maximum of efficiency. While such practice is possible in America with its compulsory education, its keen civic-minded population and unsurpassed financial resources, it is difficult to see how China, with her limited number of educated people, conservative tastes and undeveloped wealth, can hope for many years to come to attain the same state of efficiency that America has reached.



Harbin, City, incl. Pinchiang or Fuchiatien

哈爾濱街市全圖

However, the example set by a few Chinese cities, such as Canton, Nanking, Nantungchow, Peking (Eastern Ward) and Harbin, shows that modern municipal health work is being attempted on a bigger or small scale. So far as Harbin is concerned, it is expected that the passing over of a Russian to a Chinese Municipal administration since March 30th, 1926, together with the appointment of a specially trained physician as head of the Public Health Department, may result in some uniform scheme of health administration both in the Russian and Chinese halves of the city. In the meantime a description is given of the health work that has been started by the health center of Pinchiang (Chinese half of Harbin), initiated by the Manchurian Plague Prevention Service. It will be seen that certain portions of this Report are somewhat laborious but this is necessary in order to enlighten our readers as to the general state of affairs in this region.

PART I.

1. General description of the City.

Harbin (Long. 127 E. lat. 46.5 N.) is the most important town in North Manchuria, being one of the commercial centers of the Far East and the headquarters of the Chinese Eastern Railway. It occupies a commanding position, being the chief port on the Sungari River and the junction point of the main line of the Chinese Eastern Railway (Manchouli-Suifenho) with its branch line running south to Kwangchengtzu (Changchun) where it connects with the South-Manchurian Railway, and thus the Peking-Mukden Railway.

A generation ago there was not a single foreigner in Harbin, and the place itself had not even a distinct name, there being only a small fishing village called Fuchiatien (inn of Fu family) on the right bank of the Sungari. But with the coming of the Railway in 1896 a town began to grow up. Its prosperity really commenced in 1898 with the building of the Southern Branch of the C. E. Rly., running from Harbin to Port Arthur, then in Russian hands. Upon the outbreak of the Russo-Japanese war in 1904, the expansion of Harbin became so phenomenal, that it can be likened to a "boom" town such as Kansas City, America. In 1907 it was opened to international trade as one of the Treaty ports of China under the Chinese Maritime Customs. With the outbreak of the great war in 1914 the rapid development of Harbin gained fresh impetus. However, the city passed through a grave financial crisis towards the end of the war owing to the Russian revolution and the complete collapse of the rouble. The wounds inflicted by this crisis are even now not completely healed, but it may be said that the business life of the city seems to prepare for another period of prosperity, marked not by the artificial pace of former times, but by a steady rise in the exports and imports passing through it. New railways, like that via Hulan to Aigun and Taheiho, are being built or planned, which will

open up fertile regions and further the colonisation of vast stretches of arable land as well as greatly benefit the natural commercial center of the whole region. The general progress of this vast and fertile Province of Manchuria with its newly added railways will enhance the development of Harbin as well as other cities.

Harbin is divided into two halves: The former Railway Area, (now called Special Area) comprising Old Town, New Town, and Pristan (Port) and the Chinese town (Pinchiang or Fuchiatien). The total area of the city is about 55 square miles. The population varies between 300-350,000.

Before entering into a discussion of public health conditions in Pinchiang, it may be well to describe shortly the sanitary organisations existing in the Special Area which has from the beginning served as an example of Municipal development for the Chinese town. Both the city, which is now under direct Chinese control, and the Suburbs Administration, under whose jurisdiction the Old Town comes, maintain hospitals as well as sanitary departments. The Suburbs administration runs the hospital formerly belonging to the Imperial Russian Red Cross, situated in Pristan, with a capacity of 65 beds and two dispensaries, one connected with the hospital, the other situated in the Suburbs. This administration also takes care of the mentally diseased, accommodating them at $2 per head daily in the Asylum of the Railway.

The Municipality maintains besides its central health department a hospital with 195 beds, a large dispensary, a municipal drugstore and an ambulance detachment with one motor and some horse drawn ambulances; furthermore the Municipality has recently instituted a school medical service with a staff of 3 doctors. Only one senior and two assistant medical inspectors are assigned for the strictly health work, besides a disinfecting squad of four nurses and twenty attendants. The Police Department of the Special Area also has a small sanitary department. Besides medico-legal work and the treatment of the Police force, its doctors perform the following duties:

(a) Medical supervision of prostitution

(b) Supervision of drug stores

(c) Registration of Russian medical men, only properly qualified persons being officially admitted to practice as doctors or medical assistants (feldchers, midwives, etc.). Moreover this department has a dispensary for the poor, one motor and two horse ambulances.

The sanitary management of the Railway Area proper and of its employees in Harbin and other stations along the line is under the Medical Department of the C. E. Rly. It has a total staff of 573, including 50 doctors. Besides its head-office and Central Hospital at Harbin (with 270 beds and out-patients departments presided by part time specialists) the Railway maintains large and small hospitals and dispensaries along the line, so that the single medical posts are situated

at an average distance of about 142 versts (95 miles) from each other. 13 dentists stationed partly in Harbin and partly in convenient out-stations care for the teeth of the employees. The railway schools are under the supervision of special medical officers of whom there are 5 at Harbin and 5 along the line. The Medical Department of the Railway has a budget of over $900,000, while that of the Municipality reaches $200,000.

Besides the above institutions a number of other hospitals and dispensaries exist. These are maintained either by charities or private practitioners. While it is easy for the poor to find good ambulatory treatment free or at minimum prices, the hospital accommodation for poor Russians, specially chronic cases, is not sufficient. A cripples home with accommodation for 220 persons is supported by the Municipality. It is to be hoped that the proposed enlargement of the Municipal Hospital will soon be realised, as the present hospital is overcrowded.

2. CLIMATE.

The climate of Harbin may be called healthy. In winter it is also agreeable in spite of the severe cold (—15 to—30°C.). Usually there are long periods when day in and day out the sun shines, and dry cold prevails. Between these spells are short periods with higher temperature and snow. The spring is usually short, the day temperature becoming quickly raised. At the end of April, when the river opens, strong winds may blow for a few days. The summer is mild and the heat usually dry and thus comforting to most inhabitants. Moreover the periods of high temperature are never long, being separated from one another by short rainy spells or by days with a gentle and cool northern breeze. Prolonged periods with rain may occur in June or July. The autumn is warm in day time and cool at night. Frost usually begins in mid October. Our experience of the last fifteen years (1910-26) has shown a distinct tendency on the part of the weather to become milder. Meteorological data for the year 1925 are embodied in Table I.

3. MERCANTILE NOTES.

Greater Harbin is both a commercial and industrial center. Most of the industrial undertakings are connected with local staple products such as beans, oil, flour, millet, timber, etc. The factories are mainly situated in the 8th district of the Special Area conveniently near to the river and Pinchiang There are at least 22 flour mills and 40 oil mills in Harbin.

While the prices of food stuffs produced locally like meat, bread, millet, beans, etc. are comparatively cheap, imported commodities are dear owing to high freight rates when compared to other cities in China. The progressive spirit of the city is marked by many large modern establishments. Since 1920 there has been a marked decline in the number of Russian-owned shops with a corresponding increase in the

number of Chinese ones. The Russian influence is however still very marked, even in the matter of ladies' hats, to the wearing of which most Chinese women in the city have taken.

4. EDUCATIONAL INSTITUTIONS.

Pinchiang has 15 primary schools (one middle) while in the Special Area there are 24. In addition, there are quite number of private and missionary schools. Higher educational and technical institutions situated in the Special Area are admitting more and more Chinese pupils.

Although the new immigrants from Shantung are as a rule illiterate, the younger generation with the educational facilities prevalent everywhere is getting better educated in Chinese. The Russian language is very popular and youths of both sexes are encouraged to learn it at school, as a knowledge of this enhances a successful career both in official and commercial circles. A considerable number of mechanics and labourers feel quite at home in spoken Russian.

5. POPULATION OF PINCHIANG.

Until recent years there was no properly conducted census of population, and the figures were mostly obtained in a haphazard way, only the domiciles being counted and five persons being allotted for each family. Since the issuance of special instructions in 1915 by the Neiwupu (Ministry of Interior) the police authorities have undertaken a more accurate survey of the population. In Pinchiang 8 special policemen are allotted to each ward in the city and a fair degree of accuracy has been obtained. It should be noted, however, that thousands of Chinese working at day-time in the special area sleep as a rule in Pinchiang, which also serves as the recreation and shopping center of the district. The shifting nature of the population should also be taken into account, thousands often arriving daily in spring by train from the South (Chihli, Shantung, Hupeh), passing a night or two in inns of the city and then moving onwards to places along the river or railway. Towards autumn an exodus takes place from the north towards the South, but lately owing to more easy transportation and greater attraction in the development of land many immigrants have brought their families with them and settled down in distant parts. The increase of population in Manchuria from 12 millions in 1911 to 23 millions in 1925 may thus be accounted for. Pinchiang itself has increased from 20,000 in 1911 to 150,000 in 1925. Table 2 shows the increase of population of Pinchiang in five years.

The Chinese consist mostly of natives of the Three Provinces (Fengtien, Kirin, Heilungkiang), Shantung and Chihli, a small minority come from Hupeh, Chekiang, Kiangsu, Kwangtung, Fukien. etc., the most successful merchants being from Shantung. Of the foreigners 950 Japanese, 300 Koreans and nearly 100 Russians live in the Chinese City as compared with 3,000 Japanese and 65,000 Russians in the Special Area.

TABLE I.

Meteorological Returns for 1925.

(Kindly furnished by Harbin Observatory).

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
Quantity atmosph. deposits by month (Rain and Snow) in M.M.	0.7	1.7	15.5	16.1	50.8	44.5	107.8	100.8	51.1	25.1	13.2	1.9	429.2
No. days with sediment	2	5	7	4	13	10	12	11	15	4	4	3	90
No. days with snow	2	5	7	0	0	0	0	0	0	0	4	3	21
Max. quan. sediment in one day	0.4	1.0	5.4	6.2	18.4	20.4	31.8	36.9	17.4	16.4	4.6	4.1	39.9
Highest temp. C°.	-8.7	1.2	9.6	25.7	29.7	36.8	34.1	32.4	31.0	22.2	14.0	0.9	36.8
Lowest temp. C°.	-31.0	-30.5	-24.8	-10.6	1.4	5.2	14.5	10.1	2.0	-7.2	-22.9	-31.2	-31.2
No. foggy days.	0	4	0	0	1	0	1	8	2	1	3	0	20

TABLE II.

Increase of Population in Pinchiang in 5 Years.

	Actual Number.			Increase.		
	Male	Female.	Houses.	Male	Female.	Houses.
1922	60980	10876	20753.	7016	5134	3982
1923	64784	17822	26727.	3804	6946	5974
1924	69465	21178	27766.	4681	3356	1039
1925	72623	23252	28925.	6842	2074	1159
1926	74672	25285	29951.	2049	2033	1026

PART II. EXISTING SANITARY ORGANISATIONS.

6. Main Activities.

The main organisations are :

a) Wei-sang-chu (sanitary department)
b) T'ien Sheng Co.
c) Chieh Pin Co

The first is controlled directly by the police, the other two by the Chamber of Commerce, but all are supervised by the Chief of Police. No specialist in public health is employed, and the principal work of all three organisations comprises the following :

a) Cleaning and sprinkling of main streets.

b) Removal of garbage and excreta from houses and control of public latrines.

c) Registration of deaths (but not births).

d) Licensing of medical practice, drug shops, private hospitals, etc.

The "health" regulations may be roughly summarised :

A. Cleanliness.

a) Responsibility placed upon the subchief of each police ward.

b) His duties include : Disposal of refuse; location of public latrines; cattle stations; street sprinkling; planting road trees; protecting traffic.

c) Drain cleaning, such as draining rain off, removing snow, constructing new (wooden) drains, supervising drinking water, disposal of rubbish, urging the populace to follow regulations.

d) House cleaning, such as keeping closets, kitchens, compounds in order and catching rats.
e) Supervising wells, disposal of corpses and coffins, burning unnecessary rubbish, prohibiting use of shallow wells.

B. *Health Work.*

a) Responsibility of the local ward placed upon the subchief.
b) Reporting cases of infectious diseases at once, any kind of death, detaining suspicious cases, isolating patients with infection.
c) Routine health work such as clean food, examination of prostitutes, inspection of slaughter houses, licensing of practitioners, druggists and midwives, registration of weather.

C. *Medical Treatment.*

a) Establishing department for diagnosis.
b) Enforcing health regulations, such as treatment of prostitutes suffering from disease, street accidents, infectious diseases.
c) Controlling medical affairs, such as enforcement of vaccination for small-pox, inspection of private hospitals, recording numbers of patients and results of treatment, registration of opium smokers.

7. House and street cleaning.

The cleaning of a private house rests with the house-keeper. In summer the police compels him to sprinkle water and sweep that portion of the street in front of his house. The garbage is collected in a heap on the road side or dumped on a vacant lot of ground to be later collected by the scavengers three times a week. In winter when the surface freezes and snow hides everything, this garbage is often left outdoors or thrown into ditches so that when spring comes an unsightly mess is often seen. On the whole the houses and streets (especially the side ones) are dirty. In the main streets, occupied by large shops, an extra sanitary tax is paid for regular removal of rubbish; in addition two private companies receive payment of 10 cents to one dollar per month for this work. Over 200 covered carts are utilized for the transport of excreta and kitchen refuse. In the main streets, a large wooden box for rubbish is shared by every five shops so that the objectionable mess visible in the smaller roads is absent here. During the last five years practically all the business streets of Pinchiang have been paved with stones more or less regular in character. In the Main Cheng-Yang street leading from the Special Area to the Public Garden (3/4 of a mile) solid 1 × 1/2 ft. oblong blocks of granite are laid for this purpose so as to withstand hard wear. On either side of this road the drains are walled by bricks and covered over by thick wood or big pieces of granite.

8. WATER SUPPLY.

Although tens of millions of roubles were spent upon the development of Harbin City, the Russian authorities of former times never attempted to establish modern water works with such a large river close by. The result is that the Chinese have followed suit, and thousands of wells varying in depth from a hundred feet or more in the New Town to 30 feet in Pinchiang with more or less satisfactory water abound everywhere. These wells cost from 40 to 600 dollars to install, according to location. Our statistics show that out of nearly 1,000 wells examined in Pinchiang 27% are shallow (under 40 feet), 58% of medium depth and 15% over 70 feet. The water of the deep wells is clear and odourless, that of the shallow wells is usually turbid and polluted. Bacteriological investigations made by our laboratory in Harbin in January-March 1925 of 40 wells in Pinchiang showed the following :

28	(70%)	with less than 100 bact. in 1 cc.
12	(30%)	,, more ,, ,, ,, ,, ,, ,,
14	(35%)	coli positive
22	(55%)	,, negative
4	(10%)	suspicious

Although the water from these wells is not so pure as that obtained from artesian wells or modern water works, such as exist along the South Manchurian Railway, waterborne infections are not common during the summer season in Pinchiang since most of the people drink boiled water. Every street has 2-5 hot water stations for providing boiling water at cheap rates. Owing to the clayish formation of the soil the well water in Harbin is usually soft and not unwholesome: it seems, however, to be irritating to the hair and sensitive skins.

9. MARKETS.

Owing to the absence of a trained health personnel among the police employees the inspection of markets is not satisfactorily done, their arrangements and disposition being left to private corporations. The main ones are :

(a) Fish-market, started in 1921, consisting of two main barracks at the corner of 6th and main street. Size 500 sq. ft. Hours 6-11 a.m.

(b) Meat-market, consisting of 10-20 shops at the entrance of 1st Street. Busy thoroughfare crowded with people, dogs and flies. Exceedingly insanitary.

(c) Vegetable market. Over 30 shops abound in various parts of the City and are open all day. Wholesale as well as retail.

It has been proposed by the Chamber of Commerce to establish a large general market close to our Hospital. Under careful supervision this ought to be an improvement on the present state of affairs.

10. DISPOSAL OF REFUSE, LATRINES.

Considering the size of the city there are not sufficient public latrines. For instance there are in Ward I 6; in Ward II 3; in Ward III 14; in Ward IV 6. Some of these are built within the confines of theatres but accessible to the public. Most of the closets are ill built and badly kept, the excreta being collected in wooden or iron troughs removed the next day in horse drawn covered carts and dumped three miles away for fertilisation purposes. Unlike cities in the south human manure does not command a high price in Harbin, because of the natural richness of the soil. The private latrines are usually lined with porous bricks and situated on the ground, the contents being removed by hired scavengers.

11. BATH HOUSES.

Baths are quite popular among the people although they have to resort to outside establishments for the purpose since no facilities are as a rule provided at home. Some of the most attractive buildings are bathing establishments with two-thirds accommodation for males and one third for females, where massage, manicuring, and even meals may be procured. The following table shows number of baths and visitors as well daily receipts in the different wards.

Ward :	No. bathhouses :	No. bathers :	Daily receipts :
I	6	900	$250.00
II	10	1550	465.00
III	5	1000	300.00
IV	4	850	350.00
Total	25	4300	1365.00

The Government regulations for bathing houses are :

a) Laws applicable to all classes in the city.

b) Proprietors to report name, age, native city, number of rooms and price list before a license can be issued. In case of stoppage of business, the police shall be informed.

c) License and price list of bath to be prominently posted at entrance and hallways.

d) Customers to hand to manager valuable things for safe-keeping.

e) The two sexes must be separated while bathing except in the case of families.

f) Fire protection.

g) For group bathing the water should be changed at 11 p.m. (N.B. This is necessary in view of the lack of modern sewerage).

h) Proper plumbing and drainage demanded.

i) For group bathing at least one change of water a day.

k) Clean towels, brushes and tea to be provided.

l) A fine of ten dollars to be imposed for breaking laws.

In the best establishments imposing porcelain lavatories and bath tubs are provided for first and second class clients, but the third class baths usually consist of big rectangular concrete tanks (average 10 feet × 8 feet) where 4-6 persons can bathe at the time. In the poorer houses only wooden tubs are provided. The waste water is led either into an underground tank or into an open well which is cleaned in the day time. Charges for bathing vary from ten cents to one dollar. Children under five years are admitted free if accompanied by adult.

12. CHARITY HOSPITALS.

There exist five such institutions in Pinchiang.

(*a*) Plague Prevention Hospital (Pinchiang), the largest and most up to date, covering over 50 mu of land. Established in 1912 after the plague and staffed by medical officers of the antiplague service. New buildings have been added in 1920, 1922, 1924 and 1926. There is accommodation for 110 general beds besides 300 more for emergencies. Altogether $400,000 have been invested in buildings and equipment. A free polyclinic is attended daily by 80-120 patients. The following figures of attendance may be interesting:

Number of outpatients, Harbin Hospital.

1920-21	5,058	(Plague not included)
1921-22	9,345	
1922-23	15,343	
1923-24	15,661	
1924-25	22,874	

(*b*) American Mission Hospital, started in 1925 in charge of an American physician and his wife, a qualified nurse. Supported by missionary and partly by local subscription, the latter approximating $3,000. There is no proper building, only rented premises being utilized for the purpose. Average number of out-patients 30. No inpatients.

(c) Red Cross Hospital, started in 1911, but closed in 1924 because of bad management. All subscriptions raised locally. Building fund $15,000 still available.

(*d*) Catholic Hospital now being constructed to accommodate 30 inpatients with out-patient department.

(*e*) South Manchurian Railway Branch Hospital occupying rented premises in 6th Street with a Chinese and Japanese graduate (both Japan trained) in charge. There is accommodation for 10 in-patients besides out-patient department, where 30-40 cases are seen daily.

13. INFECTIOUS DISEASES. ISOLATION HOSPITALS.

With the development of rapid transport in recent times even the conservative Chinese, while holding their ancient ideas about medical practice, have come to see the need of isolation hospitals for the treatment of infectious diseases. Already the dreaded pneumonic plague has invaded the city twice, the first (1910-11) killing on the spot 7,000 out of 20,000 and the second (1921), killing 3,205 out of 300,000. The cholera epidemic of 1919 was responsible for 1200 deaths, although 80% of those admitted into our hospitals (2200) were saved by treatment with hypertonic saline transfusions. Our laboratory in Harbin has carried out important researches upon these two and other dangerous diseases like scarlet fever. But their menace is ever present because of the rapidity of travelling from infected centers like Transbaikalia, Shanghai, etc. The isolation wards of our Plague Prevention Service at present are the only ones in the City admitting plague, cholera, smallpox, typhus, scarlet fever, etc. The results achieved by the Service have been published in our Reports Vol. I-V. Besides plague prevention general hospital work has been undertaken for 15 years, and this new phase of public health research is instituted in 1926 with a view to stimulating the sanitary conscience of the country.

14. CEMETERIES. BURIAL LAWS.

The Police estimates that 1500-2000 deaths occur in Pinchiang with an approximate population of 100,000. If we add to this 10% for premature births the annual mortality comes to about 2200. Crude Death Rate is 22 per 1000 All bodies are buried, not cremated. It is only during plague epidemics such as those of 1911 and 1921 that cremation is tacitly approved by the population. It would have been better for economical as well as sanitary purposes if the Chinese adopt universal cremation like the Japanese.

The following table shows name, location, area and rental of public and private cemeteries in Pinchiang.

Name Cemetery.	Location Pol Stat.	Yearly fee.	Size of area (sq. ft.)	No. of unburied coffins.
Public C.	IV ward	1st year $6. 2nd year $3.	72,000	1700

Public C.	,, ,,	Free	266,600	—	
New C.	,, ,,	,,	2,708,640	600	removed in 1920 from Taiku Road
Sanchiang C.	I ward	$3.00	1,440,000	800	
Temporary C.	,, ,,	$12-18	2,200	720	
Chihli C.	II ward	$3.00	1,080,000	1250	
Shantung C.	III ward	$3.50	720,000	535	
Missionary C.	IV ward	Free	120,000	415	no more vacancy.
Military C.	,, ,,	,,	Unknown	0	

Burial laws are as follows :

(*a*) Before a dead body can be buried, a certificate from a physician or hospital must be presented to the Police ward. This does not apply to stillborns.
(*b*) Graves must be dug to 6 feet deep.
(*c*) Boundaries of cemeteries are strictly limited. For extension fresh applications must be made to the authorities, but this must never reach the public highway.
(*d*) Cemeteries must be kept clean and in good repair.
(*e*) Cemeteries shall be supervised by the respective police stations.
(*f*) No corpse shall be buried until after examination by the police.

PART III. NEW PUBLIC HEALTH ACTIVITIES.

15. HEALTH CENTER IN PINCHIANG.

The basis of all public health work is accurate registration of births and deaths side by side with the movement of the local population. In order to attain this with any degree of accuracy a preliminary survey of local activities such as those we have summarised above seems a *sine qua non*, not only to ascertain how much labour and money have been spent but also what degree of usefulness considered from a strictly health standpoint has been accomplished. In this matter the example of Russian administration from 1900 to 1925 has not been stimulating, since with a budget of $200,000 or more only a paltry $12,000 has been devoted to maintain one senior and two assistant medical inspectors, four disinfectors, four feldchers and 20 police attendants for the work. No registration of births is kept and registration of deaths is only perfunctorily done. No proper isolation of infectious diseases is attempted and the public is taught to rely almost entirely upon "disinfection" for their safety. Modern health activities such as child hygiene, public health nursing, epidemiology, prevention of communicable diseases, are mostly absent, the money being mainly spent upon the municipal hospital, general dispensaries, cripples home, infirmary for chronic patients and the like. This old-style attitude has reacted upon the Chinese who used to look up to Russians as advanced posts of western civilisation in their midst. To many Chinese even to-day the prevention of an infectious disease

means spraying the walls with carbolic acid and mopping the floor with sublimate lotion. The real nature of most infectious diseases is not understood. So in Pinchiang City the Police authorities, although adopting a tolerant attitude towards us, are still in the dark as to the need of an accurate survey of births, causes of deaths, strict isolation of communicable diseases, vaccination, treatment with serum for diphtheria and scarlet fever, laboratory diagnosis, and the like. True, we have been repeatedly asked to analyse foods, aerated water, patent medicines, anti-opium pills, etc., but in the matter of district nursing, child hygiene, inspection of food markets, stables, we are still unable to move. As has been seen above, there are plenty of so-called sanitary laws, but they are not scientifically drawn up or intelligently enforced. The result is that dung heaps accumulate in cattle sheds and stables, which are distributed all over the city and breed innumerable flies during summer. Food markets are conspicuous for their insanitary conditions, and unless an epidemic of serious character threatens, the advice of our doctors is rarely acted upon. Much public money raised from taxes which could easily contribute to the expenses of proper health work, is merely wasted upon spasmodic cleaning of streets and yards by an army of slow workers. Perhaps this *laisser faire* attitude is due here as in other cities of China not so much to an unwillingness to help as to a want of knowledge of the real requirements of public health, brought on by centuries of ancient classical studies.

Hence we have thought it wise to commence our health survey from January 1, 1926, in spite of all discouragements, and have opened a special health center as one of the activities of our Plague Prevention Service. This department is presided over by Senior Medical Officer Lin-Chia-Swee, assisted by six trained inspectors and eight police men. All expenses including printing of notices and pamphlets are borne by us, but we are confident that within the next year our efforts will have produced such encouraging results and aroused so much public interest that the authorities and wealthy organisations of the city will contribute substantial funds to enhance the success of our mission.

16. Scope of work.

Work was started on January 1, 1926, each of the four wards being in charge of a sanitary inspector assisted by police organs. For the first six months under review (January to June) our work was restricted mainly to a survey of local activities as well as to preliminary observations on the population, housing, restaurants and eating houses, barber shops, prostitution, number of births and deaths, infectious diseases, number of medical practioners, dentists and midwives, etc. These will be dealt with in order. Records of theatres, dairies, markets, slaughter houses, etc., will be supplied later on.

i. Housing and living conditions.

Since the beginning of the World War (1914-18) the mud and straw huts of plague times (1911) have mostly been replaced by substan-

tial multistoried brick houses, often of an imposing character. The tall ones usually have a big yard in the middle of the compound with one or more wells. The modern edifices facing the main Cheng-Yang street are second to none in China, while even the secondary streets can boast of up-to-date establishments. There is one public garden of about 12 acres in extent towards the eastern extremity of the main street, otherwise open air spaces for recreation are absent in this city of 100,000 inhabitants. No modern zoning system is as yet adopted. As in many other cities, different groups of people tend to live together, the poorer families congregating around the theatre and market districts. The absence of water-works and modern sewerage is a considerable handicap. There is no particular residential district for families. The red-light district is an imposing center, consisting of a circle of over one hundred two-storied houses facing a nicely planted garden with an open air summer restaurant in the middle. Along the main thoroughfares poplar trees have been planted for over 7 years. To provide for the floating population hundreds of inns with accommodation for 20-240 persons each have been erected together with a corresponding number of eating houses. In times of epidemic the low class inns are hotbeds of infection. It would be a good thing for all if municipal lodging houses of a sanitary character were to replace some of the dirty hovels now occupied by ricksha coolies and day labourers.

The accompanying Table III shows results of our inspection of houses and living conditions in the four wards of Pinchiang. Altogether 7722 houses were investigated and 35,765 inhabitants questioned.

TABLE III SHOWING THE RESULTS OF INSPECTION OF HOUSING AND LIVING CONDITIONS IN 4 WARDS OF PINCHIANG.

Direction and construction.	W. I.	W. II.	W. III.	W. IV
Facing South	30%	40%	20%	25%
,, North	30%	30%	20%	32%
,, East	24%	20%	35%	22%
,, West	16%	10%	25%	20%
Two-storied or more	53%	30%	20%	35%
Brick wall and tiled roof	32%	40%	34%	30%
Mud and straw roof and wall	14%	30%	36%	20%
Wooden construction	1%	2%	10%	5%
Good ventilation and lighting	70%	60%	75%	65%
Imperfect ventilation and lighting	30%	40%	25%	35%
Good drainage	60%	65%	30%	15%
Imperfect drainage	40%	35%	70%	85%
People eating rice and meat	30%	20%	24%	35%
People eating rice, flour and vegetable,	40%	40%	35%	45%
rarely meat	30%	40%	41%	20%
People eating poor mixed barley and absolutely no meat				
No. of houses inspected	5212	2439	7732	3347
No. of people inspected	25502	12493	35765	14387

ii. Prostitution.

Pinchiang being both a quickly growing city with a preponderant male population and the main recreation center of the district, it is natural that the prostitute element should be an important factor in the life of the city. The absence of Chinese prostitutes in the Special Area (where only Russian, Japanese and Korean girls numbering 800 abound) apparently increases the influx of customers into the Pinchiang brothels. Our statistics show that in 1921 there were as many as 3500 Chinese prostitutes in the Chinese city but because of the recent slump in trade this number has diminished to just under 2000 in the present year. As in other big Chinese cities there are four or five classes of women from the superior singing girl charging $4 for a song to the lowly fifth grade prostitute accepting a fee of 40 cts. The latter class, who are settled over the city, are in the majority and responsible for the excessive venereal diseases among the poorer population. Table IV shows results of inspection of prostitutes in the four wards of Pinchiang.

TABLE IV SHOWING RESULTS OF INSPECTION OF PROSTITUTES IN 4 WARDS OF PINCHIANG.

Ward.	First class.	Second class.	Third class.	Lower class.	Secret without license.	Remarks.
I	64	82	64	65	40	Secret prost. are only approx
II	—	—	—	—	18	Secret prost. calculated by inspection as there are no licensed ones.
III	105	185	355	—	250	Most of the sewing girls are secret prost. in this ward.
IV	40	230	276	95	30	Secret prost. in this ward calculated by inspection.
Total	209	497	695	160	338	The total no. of prost. in this city is about 2 thousand.

Police Regulations for control of licensed prostitutes.

(*a*) No person can open a brothel without a license.
(*b*) Applicants must first be registered and pay the stipulated tax according to class.
(*c*) Full data as to name and age of proprietor, location and number of rooms, number and names of prostitutes, class of brothel, name of house, personal history of proprietor and assistants to be supplied.
(*d*) Prostitutes themselves must supply name, age and native home; names of parents, if any; name of husband, if any; reasons for occupation; number of years in the trade; previous movements.
(*e*) No one under 16 is allowed to be a prostitute.
(*f*) No one is allowed to live outside the limits designated.
(*g*) Brothels must be plainly named at entrance of house.
(*h*) No singing or noise allowed before 9 A.M. or after midnight.

(*i*) Inmates shall charge only prices fixed by Police according to their rank.

(*j*) Any of the following happenings must be reported immediately by telephone to the police: Suspected robber in customer, suspected prisoner in customer, any infectious case, any death, any drunkard, any person with arms or dangerous implements, any inmate absent from the house for 24 hours.

(*k*) Inmates must submit to medical inspection if required.

(*l*) Any inmate disobeying the police regulations may be suspended.

(*m*) The brothels must be opened to inspection at any time.

(*n*) Fines are imposed for: false statement regarding age etc., infringement of articles c,d,g, refusing physical examination or police inspection.

(*o*) Fines not to exceed $30 for each violation of law.

iii. Restaurants and Eating Houses.

There are altogether 232 eating houses or restaurants in the city, only four belonging to the first class. Our inspection showed that in 85% of these the kitchens and toilet rooms are close together, refuse and garbage are placed in uncovered iron pails or wooden tubs which are not emptied until almost full. All food stuffs whether hot or cold are not kept in cupboards or screened boxes. Cooking utensils are seldom kept clean. 96% of the 3rd class and 56% 2nd class eating houses have their kitchens immediately after entrance from the front door. Table V shows result of our inspection of eating houses. Because our inquiry was conducted in the winter and spring, the fly and mosquito records are not available.

TABLE V SHOWING INSPECTION OF EATING HOUSES.

	Class	No. houses	No employ.	No. Chien (room units)	Sanitary condition.
Ward I.	1st.	1	27	35	Kitchen and eating rooms good condition.
	2nd.	4	92	52	Eating rooms good. Kitchen fair.
	3rd.	67	623	298	Very poor.
	1st.	1	32	55	European style good.
Ward II.	2nd.	1	10	12	Fair.
	3rd.	13	67	28	Poor.
	1st.				
Ward III.	2nd.	12	98	69	Poor.
	3rd.	92	572	136	Worst in the city.
	1st.	2	128	132	European style fair.
Ward IV.	2nd.	10	158	120	Fair.
	3rd.	29	148	63	1/3 fair and 2/3 poor.

NB. Good means most arrangements satisfactory
Fair ,, 60% passable.
Poor ,, unclean in most respects.
Very Poor ,, absolutely to be condemned.

Police regulations governing restaurants and eating houses.

(*a*) All restaurants and eating houses must be licensed.
(*b*) Any person opening a restaurant must supply name, age, native home etc. The license must be returned on stoppage of business.
(c) Every keeper must produce guarantee from two shops.
(*d*) Price list of food shall be prominently posted in each room.
(*e*) Number of tables allowed shall be fixed by the Police.
(*f*) Light and fresh air in rooms shall be plentiful.
(*g*) Police may inspect at any time.
(*h*) No customer shall be forced to order more than necessary.
(*i*) Any misunderstanding with customers shall be reported to Police.
(*j*) All eatables must be kept absolutely clean.
(*k*) A fine not exceeding $15 to be imposed for violation of b-k.

iv. Barber shops.

No laws exist at present for the regulation of barber shops but this enquiry has been specially devised by us to ascertain the number of shops, implements, persons engaged in occupation, their working rooms, sleeping quarters (whether separate or in the working rooms), living and kitchen conditions, etc.

Barber shops may roughly be divided into three classes, the first catering to about 200 each, the second to 100 and the third to 60 customers daily. Rates vary from 10-30 cents for complete shaving, and hair cutting, massage and shampoo. The number of employees varies from 8 to 15, some of whom are mere tea attendants and sweepers. As a rule the big bath houses also employ barbers for their clients. Sterilisation of razors, scissors, combs, brushes, etc., by steam or chemicals is not practised, and the small cotton mask hung over respiratory entrances which one sees on some Japanese barbers is never encountered. The barbers usually do not wash their hands except when performing the shampoo. In the first class houses two or three fresh towels are provided for each customer, but the lower grade ones use them on several customers in succession and wash their linen once in the evening. In 70% of the shops spitting on the floor is universal both among barbers and visitors, spittoons being seldom provided. About 15% of the attendants show signs of Tuberculosis or skin diseases. Once we saw a young man with peeling skin just recovering from smallpox. Syphilis is quite common. Except the proprietors who usually enjoy a room behind the shop with their family, most of the employees sleep on *improvised* couches in the working room after their day's work. Business hours are from 8 A.M. to 10 P.M. No exercise is possible since they take their meals in the shop.

Table VI shows the results of our investigations regarding barber shops.

TABLE VI SHOWING INSPECTION OF BARBER SHOPS.

Ward	Class.	No. barber shops	No. Chairs	No. employees	Sanitary condition.	Sleeping quarters including rooms.
I	1st.	6	62	72	4 imperfect vent. 2 imperfect lighting none clean.	2-5 rooms. Sleep accom. limited. Use 3 wooden kang. No kitchen.
	2nd.	10	72	68	7 imperfect vent. 2 lighting & dirty.	2-3 rooms. Sleep on temp. couches.
	3rd.	12	48	58	All dirty & even barbers not clean.	1-2 rooms. Sleep on floor only. No special sl. quarter.
II	1st.	2	16	28	Good vent. & light. Instru. not quite clean.	3-5 rooms. Sleep qr. with kangs and special kitchen.
	2nd.	4	12	17	Good lighting but bad ventilation.	2-4 rooms. Sleep on floor.
	3rd.	2	5	12	Everything dirty. Good ventilation.	1 common room. Sleep on floor.
III	1st.	17	153	131	5 European style. 12 good vent. and light.	3-8 rooms. 50% Sl. on temp. couch.
	2nd.	16	102	128	50% bad condition.	2-3 rooms. 90% sl. on temp. couches.
	3rd.	14	11	16	Worst cond. & 70% seen spit on floor.	1-3 rooms. no. sl. qu. or kitchen.
IV	1st.	4	32	39	1 European style. 3 good condition.	2-6 rooms. Sl. on temp. couches.
	2nd.	9	49	44	Poor condition. 30% spit on floor.	1-3 rooms. No sl. qu. or kitchen.
	3rd.	4	16	16	Bad condition. 80% spit on floor.	1-2 rooms. Sleep on floor.
Total	1...29 2...39 3...32	100	578	629		

v. Hotels, lodging houses and inns.

No health regulations exist for hotels or inns in Pinchiang City although these are of the outmost importance in times of epidemic. Our figures show that there are 110 establishments in Ward I, 2 in Ward II, 52 in Ward III and 14 in Ward IV. The biggest one accommodates 240 and the smallest one 30. Charges vary from 5 cents to $3 per day. The lowest inn only supplies resting place at night on the K'ang (raised heated brick platform) with no toilet facilities. The high class hotels are steam-heated and have modern plumbing with up-to-date (not always well kept) toilet facilities. The biggest hotel Hsin-Shih-Chieh (New World) has accommodation for 60 guests on third floor as well as a large Chinese and foreign restaurant on second floor, and shops and a movie show on ground floor. Capitalisation $600,000.

17. REGISTRATION OF PRACTITIONERS, DENTISTS AND MIDWIVES.

Any person desiring to practise medicine is required to pass examination by the police. Formerly our Senior Hospital Staff were requested to undertake this task but with the continual change of police chiefs, each possessing a different idea of his competence, there has not been a regular system of examination for over 5 years. Regulations are published but seldom enforced. A license to practise is quite easy to obtain from the Police if the requisite fee is paid. Only a limited knowledge of Chinese or foreign medicine or even a few months of apprenticeship in a drugshop is sufficient. During recent years the number of western practitioners, often with imposing shops, where Japanese wax-models of V.D. are shown at the windows to impress the ignorant, have greatly increased in number. A lucrative business is carried on by most of these people, since charges of $10-30 are made for injections of salvarsan or equivalent solutions. Many prepare their own patent medicines and shamelessly advertise them on theatre programs, in newspapers, at restaurants, on the stage screen, and even at places of worship.

A separate register is kept for midwives, but these are not obliged to pass examinations. Dentists because of their mechanical skill, not mentioned in ancient books, find few rivals among the mere bookworms and untrained. Their charges are about 20% of those usually prevailing in the west. *Table VII shows* the number of medical practitioners, midwives and dentists.

TABLE VII SHOWING NO. OF MEDICAL PRACTITIONERS MIDWIVES AND DENTISTS.

	Ward I.	Ward II.	Ward III.	Ward IV.	Total	Remarks.
Native style Chinese physicians	29	18	36	14	97	Usually attached to drug shops.
Western trained qual. Ch. practitioners ..	Korean 1	Korean 4	Korean 3 Japan. 1 Ch. 6	3	18	Possessing certificate.
Western imperfect trained Ch. practitioners	24	1	10	15	50	Formerly assistants in dispensaries.
Ch. native midwives.	6	14	22	8	50	Usually untrained women.
Western trained midwives	4	1	4	2	11	Nursing certificate.
Dentists	5	1	4	1	11	None from proper school.

As the population is about 100,000 at present the above figures show :

One native trained physician	for each	1,000	population.
,, western ,, ,,	,, ,,	7,000	,,
,, ,, imperfect	,, ,,	2,000	,,
,, ,, midwife	,, ,,	10,000	,,
,, old-style midwife	,, ,,	2,000	,,
,, dentist	,, ,,	10,000	,,

Police regulations for medical practitioners.

(a) Any person having satisfied the police authorities in an examination is licensed to practise medicine.

(b) Full data regarding age, native place, address and medical knowledge are required from an applicant who must show at least a 3 years' course in a Chinese or foreign Medical College and secure a certificate to be verified by the police.

(c) No application is considered unless applicant has studied the action of drugs and the treatment of diseases.

(d) When applying for license a photo of applicant and a fee of $2 must be sent.

(e) A medical practitioner must keep a patient's register, mentioning date, name of patient, sex, age, diagnosis and prescription. For wrongful treatment he may have his license suspended or cancelled.

(f) When a practitioner opens a hospital he must report age, sex, native home, history of the dispenser and nurse, and their certificates should also be shown when required. When foreigners are employed, the contract must be shown to the Police for approval.

(g) Any practitioner having a pharmacy in his office must submit to the same laws required for ordinary pharmacies.

(h) Practitioners shall report monthly on forms issued by police cases treated by them. In cases of communicable diseases or poisoning the Police shall be at once notified.

(i) When a practitioner resigns from practice, he shall send his license to the police for cancellation.

(k) Any practitioner convicted of wrongful act may have his license suspended or cancelled.

(l) For violation of regulations the practitioner is liable to a fine or imprisonment

Police regulations for midwives.

(a) Any person applying for license as midwife must present full data regarding name, age (not under 30 years), husband and children (if any), native city, address, security, diploma, fees and personal history.

(b) A foreigner must present a certificate from her school.
(c) License fee shall be one dollar.
(d) A license must be procured from the Police for practice.
(e) A sign board shall be hung up at the entrance of house.
(f) Any change of residence must be reported.
(g) In case she retires the same must be reported for withdrawal of license.
(h) In case she gets too old or infirm for work she must apply for withdrawal.
(i) Licenses are not transferable.
(k) In case of loss or damage a new license can be procured without extra fee.
(l) A midwife may not refuse calls, demand big fees, perform abortion, unnecessary operations or give medicines injurious to baby or pregnant woman. Exception is allowed when cutting the umbilical cord or performing rectal injections. No exchange of babies is permitted.
(m) Every midwife must report each fresh case to the police with name, address, condition of baby, mother and other important matters.
(n) In case of serious complication a medical practitioner must be called in.
(o) Should a midwife have her license suspended, she may claim same after a period of good behaviour.
(p) A fine not exceeding $30 may be imposed for violation of laws.

18. Supervision of private hospitals and drug shops.

Private hospitals number 22 of which five are of proper standing. The latter treat from 30-50 outpatients a day and charge an average of 50 cents apiece. Medicines approximate $1-5. Only two hospitals admit in-patients, a Japanese with 15 beds and Korean with 6 beds. No co-operation exists between private hospitals and health authorities.

Patients apparently prefer to try first the skill of private practitioners and often expend all their money there before they consult the better equipped Government institutions, where only nominal rates are charged. At some of the smaller "hospitals" questionable practices are indulged in, such as opium smoking, morphine injections, abortion, etc.

Drug shops : Of these 92 sell native Chinese medicines, and 62 western drugs. The daily receipts vary from $10-50 in old style shops while the biggest western pharmacy claims sales of $500 per day. Patent medicines form the bulk of the sales in the western shops. As many as 5000 different varieties of patent medicines are in the market, and if only a five percent stamp tax (comparable to the present 20% tax on tobacco) could be levied on all such medicines and the proceeds devoted to public health work throughout the country we should make

much quicker progress and at the same time relieve the population of many imaginary sicknesses. It should be added that a large number of the drug shops deal in morphine and other opium derivatives under the name of anti-opium pills, nerve building elixirs, cough cures, headache medicines, etc. Hundreds of samples analysed by us have proved the presence of opium in one form or another. Large quantities of morphine, heroin, cocaine, etc. are continually smuggled into the country nowadays from Japan, Germany and Switzerland, usually through foreign agents. Police regulations are confined to western drugs stores, not old style shops.

Police regulations governing trade in poisonous and powerful chemicals.

(a) Any person dealing in above must obey the following laws :
(b) Under drug merchants are included druggists, dispensaries, petty drug sellers and street hawkers dealing in medicines.
(c) All druggists must provide data regarding name, age, native city, location of shop, capital and class of business.
(d) Must procure license from police.
(e) Must have fixed address.
(f) Must report manufacture, import and daily sale of poisonous and powerful chemicals.
(g) Petty traders not allowed to deal in above.
(h) Opium, morphine, cocaine and similar narcotics and instruments for injection are prohibited. For medical purposes, these may be imported only on special conditions.
(i) Petty dealers not allowed to deal in above.
(j) No druggist shall sell false medicines.
(k) Aphrodisiacs and abortives are prohibited.
(l) All drug shops and their books shall be open for inspection to police.
(m) A fine up to $60 may be inflicted for violation of c,f,g.
(n) A fine up to $30 may be inflicted for violation of h & i and goods confiscated.
(o) Any druggist convicted of a wrongful act may have his license suspended or cancelled.
(p) Such suspension may be withdrawn at the will of police.
(r) Violation of more than one article may mean double fines.
(s) For any wrongful act of an employee the proprietor of the shop shall be held responsible.

19. HEALTH PROPAGANDA.

For over five years our Plague Prevention Service has devoted considerable attention to the question of health propaganda among families, schools, mercantile establishments, and public resorts. Lectures have also been given to the masses as well as school children and out-patients. This branch of activity may be summarised as follows :

a) Public Health Journal. Besides tracts, posters and pamphlets, over 10,000 of which are distributed yearly on such common infections as small-pox, plague, cholera, scarlet fever, bowel diseases tuberculosis and venereal diseases, trachoma, child hygiene, etc., we are publishing an illustrated bi-monthly journal on Practical Hygiene (100-150 pages), two thousand copies of which are distributed among all government institutions, schools, popular book stores, etc. at cost price (10 cents).

b) Free tickets for vaccination. Small-pox still claims a heavy toll among children in all parts of China. Harbin is not excluded and the neighbouring Russians also suffer. At Harbin we have vaccinated at least 3000 yearly, but this number can be largely increased if we produce our own vaccine which we hope to do in the next year. For scarlet fever we are pioneers in the Orient of the Dick test and systematic immunisation, over 3000 injections having been given in the latter part of 1925 among children and adults during a serious epidemic. With the development of our activities we hope to attract the majority of children to our four health stations for free vaccination against small-pox and thus demonstrate the feasibility of a variola-free city in China.

c) Motion pictures and lantern slides. These are often shown at public gatherings and benefit theatres. In summer they are interspaced with ordinary pictures in the public gardens.

d) Our health officers have given lectures at Y.M.C.A. meetings, school classes and public functions.

20. SPECIAL INVESTIGATIONS.

i. Bacteriological examination of wells. Already mentioned. See 8.

ii. Examination of stools. On the first occasion, upon 220 inhabitants with following results :

(a)

Parasites seen	No. cases.	Percentage.
Ascaris lumb.	42	19.1
Trichoceph. dispar.	5	2.3
Bothrioceph. latus	3	1.4
Ascaris and Trichoceph.	2	0.9
,, and Botrioceph.	1	0.5
,, and Trichom. int.	1	0.5
,, and Ankylost. duod.	1	0.5
Taenia solium	1	0.5
Ankylost. duod.	1	0.5

(b)

On the second occasion upon 350 inhabitants with the following results :—

Parasites seen.	No. cases.	Percentage.
Ascaris lumb.	69	19.7
Trichoceph. trichiurus	16	4.6
Ankylost. and Necator	18	5.1
Trichostrong. orient.	3	0.8
Clonorchis sinensis	2	0.6
Metagonimus Yokogawai	1	0.3
Paragon. Westerm.	1	0.3
Oxyuris vermicul.	1	0.3
Taenia	2	0.6

These two tables may be compared to Faust's records for the Yangtze Valley. (Ch. Med. Jl. 1921).

Parasites seen.	Percentage.
Giardia intest.	3.0
Trichomonas hominis	0.6
Spiroschaudinnia eurygyrata	0.3
Balantidium coli	0.3
Ascaris lumb.	54.3
Trichuris trichiura	36.2
Ankylost. and necator	22.0
Strongyl. stercoral.	0.3
Schistosoma japon.	3.6
Fasciolopsis buskii	0.6

The above figures tend to show that the poor inhabitants of this city are not so heavily infested with intestinal worms as in China proper. Reasons for this may be : Dry climate, strong sun, limited use of human excreta for manure, non-eating of raw fish, etc.

iii. Physical examination of school children.

For this purpose 13 primary schools with 1137 male pupils were investigated, the results being tabulated as follows :

NB. A summary of our records may be interesting—

a) 74.23 may be classed 'excellent physical development', 22.6 'poor posture' and 3.16 'evident physical defect.'

b) 30.52 show evident signs of trachoma.

c) 12.22 have decayed teeth.

d) 1.14 possess enlarged tonsils.

e) 11.34 bear signs of skin disease.

f) 1.23 display evident symptoms of tuberculosis.

TABLE VIII WEIGHT, HEIGHT AND CHEST MEASUREMENTS.

(1137 male school pupils).

		(Weight)			(Height)			(Chest measurements)		
Age.	No. of cases.	Aver-age.	Max.	Min.	Aver-age.	Max.	Min.	Aver-age.	Max.	Min.
7	64	40.3	59.0	28.½	41.0	47.5	38.0	20.0	22.5	19.5
8	98	45.6	60.0	34.0	41.9	47.0	41.0	22.2	23.5	19.5
9	118	46.7	68.0	33.0	44.3	58.5	42.0	22.3	25.5	20.5
10	185	54.0	71.0	42.0	48.2	59.0	37.5	23.7	25.0	21.0
11	159	58.7	96.0	42.0	50.0	56.0	49.0	23.1	26.0	20.5
12	169	63.1	82.0	44.0	51.0	56.5	49.5	24.5	26.5	21.5
13	154	68.5	104.0	52.0	52.2	57.0	50.0	24.3	27.0	22.0
14	101	72.4	98.0	52.0	53.8	58.0	49.0	25.2	28.0	22.5
15	96	81.6	118.0	50.0	55.5	61.0	53.0	26.2	30.0	23.5

TITLE IX SHOWING OTHER HEALTH PARTICULARS OF 1137 PUPILS (Male).

Age.	Total cases.	Trachoma.	Short sighted.	Colour blind.	Half blind.	Poor hearing.	Otitis.	Decayed teeth.	Enlarged tonsils.	Skin disease.	Signs of T.B.	Anemia.	Weak heart.	Hernia.	Excellent physical develop.	Poor posture.	Evident physician defects.
7	62	12	—	—	—	—	—	14	—	9	—	3	—	1	48	12	2
8	99	20	—	—	2	—	—	17	1	14	3	3	—	—	75	18	6
9	118	32	—	—	—	—	1	14	3	11	2	2	2	—	91	23	4
10	185	54	—	—	2	—	1	32	2	23	3	4	1	1	134	49	2
11	158	34	1	—	5	—	—	18	1	26	—	3	2	—	122	30	6
12	166	48	—	1	4	1	—	22	4	10	1	2	—	1	120	39	7
13	154	58	1	—	3	—	1	15	2	22	3	7	3	—	115	35	4
14	100	42	2	1	4	1	—	6	—	6	1	4	—	—	69	27	4
15	95	46	2	—	1	3	1	1	—	8	1	2	1	2	70	24	1
Grand Total	1137	346	6	2	21	5	4	139	13	129	14	30	9	5	844	257	36
Percentage		30.5	0.5	0.2	1.8	0.4	0.4	12.2	1.1	11.3	1.2	2.6	0.8	0.4	74.2	22.6	3.1

iv. Physical examination of infants.

TABLE X SHOWS THE RESULTS OF PHYSICAL EXAMINATION OF 260 INFANTS (BOTH SEXES) FROM 1-20 MONTHS.

Age in month.	No. cases.	Body weight (lbs.)	Body height (in.)	Head measurement (in.)	Chest measurement (in.)	Abdominal measurement (in.)	Remarks.
1	28	11.1/3	18.1/5	15.0	14.0	13.1/3	wt incl. light clothes (av. 1/2 lb.)
2	19	12.1/4	20.1/4	15.1/3	15.0	15.0	,,
3	10	14.1/2	22.1/2	15.1/2	16.0	16.1/3	,,
4	10	15.1/2	23.0	16.1/4	17.1/2	16.1/2	,,
5	16	16.1/2	24.0	17.0	16.0	16.1/2	,,
6	20	17.0	24.1/2	16.1/2	16.1/2	17.0	,,
7	31	17.1/2	25.1/2	16.1/2	16.3/4	17.1/3	,,
8	10	17.3/4	25.1/2	16.3/4	17.0	17.1/2	,,
9	8	17.3/4	26.1/2	17.0	17.0	17.1/5	,,
10	8	20.1/2	26.2/3	17.1/2	17.3/4	17.1/2	,,
11	10	19.1/2	28.2/3	18.0	17.1/2	17.2/3	,,
12	10	20.0	28.1/2	17.1/2	17.1/2	16.1/2	,,
13	10	19.0	27.0	17.1/3	17.1/2	16.1/2	,,
14	12	22.0	29.1/2	18.0	18.1/2	18.1/4	,,
15	7	21.1/3	30.1/2	17.1/2	17.1/2	17.0	,,
16	4	20.1/2	30.1/3	17.1/2	18.1/4	17.1/2	,,
17	15	22.1/2	30.1/2	18.1/2	18.1/2	18.0	,,
18	5	21.1/2	30.1/2	17.1/2	17.1/2	18.1/4	,,
19	8	22.1/2	30.1/3	18.0	18.1/2	17.1/4	,,
20	19	21.1/2	30.1/2	18.1/2	17.0	18.1/2	,,

v. Dick tests on 1275 inhabitants.

These tests were conducted in the summer of 1925 on 1275 normal persons from infants to adults. The age groups are also given. Our results show a high percentage of positive reactions in this city as compared with those in America (see Zingher's Table).

TABLE XI DICK TEST WITH DIFFERENT AGE GROUPS ON 1275 INHABITANTS OF PINCHIANG.

Age.	Total cases.	Dick Neg.	Dick positive.			Positive percentage
			+	+ +	+ + +	
1-4	15	1	1	2	11	93.3
5-9	36	11	10	9	6	69.4
10-14	194	95	46	34	19	51.0
15-19	303	116	113	38	6	51.8
20-24	224	114	72	36	2	49.1
25-29	160	87	59	14	0	45.6
30 over	343	214	94	34	1	37.5

The above shows a high percentage of positive reactions as compared with those made in other countries. Compare with Zingher's table as follows :—

ZINGHER'S TABLE (JL. AM. MED. ASS., 1924, VOL. 83, P. 435)

Age.	Total tested.	Dick Post.	Dick Neg.	Dick post. Per cent.
0-6 months	29	13	16	44.8
6-12 ,, ...	42	27	15	64.2
1-2 years	123	87	36	70.7
2-3 ,, ...	140	95	45	67.8
3-4 ,, ...	207	123	84	59.4
4-5 ,, ...	237	110	127	46.4
5-10 ,, ...	1,475	522	953	35.4
10-15 ,, ...	1,690	430	1,260	25.4
15-20 ,, ...	285	75	210	26.3
20 years up	342	61	281	17.9
Total	4,570	1,543	3,027	34.4

vi. Dick tests in 6 schools.

Here 542 pupils of both sexes with ages varying from 3-20 years were tested. The highest percentage of positives (86.1) was obtained in the Kindergarten (age 3-6), though the minimum percentage of positives in any one school was 30.

Table XII. Dick test according to 6 schools, Pinchiang.

Name of School.	Total.	Negative.	Positive			Positive percentage.
			+	++	+++	
Mission high girl sch. (age 9-20)	80	45	20	12	3	43.7
Mission Prim. girl sch. (age 7-14)	51	17	12	14	8	66.6
Gover. Orphanage (age 9-18)	131	92	23	10	6	29.7
Commercial sch. (age 15-30)	154	88	56	10	0	45.8
Chi Yeh School (Age 10-16) ...	103	69	32	2	0	33.0
Mission Kinder. (Age 3-6)	23	3	6	8	6	86.1

21. Statistics of Communicable Diseases.

Owing to overcrowding and ill-ventilated rooms, especially among the poorer classes, tuberculosis is rife in Pinchiang. At least ten per-cent of admissions at our polyclinic show tuberculosis in one form or another. In the ten months (Feb.-Dec. 1924), 1705 cases out of 16,597 seen by us belonged to this group. In order of frequency, they are of the glandular, osseous, articular, pulmonary and skin types. Since Chinese do not drink cows milk, the source of infection is evidently human. In our surgical department, amputations above the angle are frequently performed for discharging and incurable sinuses of the lower extremity. Southern (damper) cities show a higher percentage of pulmonary as compared with glandular cases.

During the last five years scarlet fever, often in a malignant form, has caused much havoc among the people and is an important cause of death every autumn and winter. Sometimes families lose all their children within a fortnight during an epidemic, the disease attacking rich and poor. Both adults and children are often attacked together, but a considerable percentage of the former survive while the tender-aged ones perish. Owing to dread of hospitalisation and an insufficient know-ledge of the value of isolation, it has been difficult for us to save lives

even where such is possible or to keep accurate records of its true incidence among the population. Perhaps a certain predisposition to this newly imported infection may also account for its virulence among Chinese, who seem on the other hand to be better immunised against typhus, small-pox, etc. A list of scarlet fever cases occurring in private families, showing familiar features, may contribute something towards the epidemiology of this new disease. (See Table XIII). From the

Table it will be seen out of 16 families studied, there were :

Adults	m.......19	Died m....... 0	%deaths....... 0
,,	f........27	,, f 1	,, ... 3.7
Children	m.......18	,, m....... 9	,, ...50.0
,,	f........28	,, f........20	,, ...71.4

TABLE XIII. SCARLET FEVER IN FAMILIES (Pinchiang) 1926.
(Showing severity among children).

No.	Name.	Occupation.	No. persons in family.				No. Scarlet fever cases seen.				No. Cured.				No. Died.				Ages of Cases D. Died C. Cured.				Remarks.
			Adults		Children		Adults		Children		Adults		Children		Adults		Children		Adults		Children		
			M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	
1	Chang	Merchant.	1	4	...	4	...	...	...	4	..	...	...	1	...	...	...	3	...	...	...	D. 13 D. 8 D. 4 C. 2	
2	Hung	Bank, of China.	1	1	1	1	...	...	1	1	...	...	...	...	...	...	1	1	...	...	D. 11	D. 8	
3	Fu	Landlord Cantonese.	1	2	3	2	...	1	3	2	...	1	3	...	...	...	...	1	...	C. 28	C. 11 C. 6 C. 3	D. 8	
4	Wu	Dir. teleg. office.	1	1	1	1	...	...	...	1	...	...	...	...	...	...	..	1	...	...	...	D. 12	
5	Yung	Section chief Bank Ch.	1	2	...	2	1*	1	...	2	1	1	...	...	...	...	...	2	C. 32	C. 28	...	D. 5 D. 2	*Infected by case 2.
6	Wong	Servant Am. Bank.	1	1	1	2	..	...	1	2	...	...	...	...	...	...	...	2	...	...	C. 15	D. 6 D. 4	
7	Tu	Customs sailor.	1	4	1	3	...	1	1	3	...	1	...	...	...	...	1	3	...	...	D. 8	D. 6 D. 3 D. 2	
8	Hwang	Post Off. clerk.	1	1	2	3	1	1	2	3	1	1	...	1	...	...	2	2	C. 30	C. 25	D. 14 D. 10	D. 6 D. 4 C. 3	

TABLE XIII. SCARLET FEVER IN FAMILIES (Pinchiang) 1926.—(*Continued*).
(Showing severity among children).

No.	Name.	Occupation.	No. persons in family.				No. Scarlet fever cases seen.				No. Cured				No. Died.				Ages of Cases D. Died C. Cured.				Remarks.
			Adults		Children		Adults		Children		Adults		Children		Adults		Children		Adults		Children		
			M.	F.	M	F.	M.	F.	M.	F.	M	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	
9	Chen	Telegrap. clerk.	1	1	...	...	1	1	...	...	1*	...	...	...	...	1	...	...	C.32	D. 28	...	...	*Nephritis for one year.
10	Lin	Interpreter B. A. F.	2	2	...	2	...	...	...	2	...	...	...	2	...	...	...	...	...	...	...	C. 5 C. 2	
11	Ho	Merchant.	1	2	1	2	...	...	1	2	...	...	...	...	...	...	1	2	...	...	D. 5	D. 2 D. 1	
12	Yin	Workman.	1	1	3	...	...	...	3	...	...	...	1	...	...	...	2	...	...	...	C. 5	D. 8 D. 3	
13	Lee	Teacher.	3	1	2	...	...	...	1	...	..	...	1	...	...	...	...	...	...	...	C. 7	...	
14	Tsong	Post Off. clerk.	1	1	1	1	...	...	1	1	...	...	...	1*	...	...	1	...	...	...	D. 4	C. 3	*Infected by case 8.
15	Chen	Native Phys.	1	2	1	4	1*	...	1	3	...	...	1	...	...	...	...	3	...	...	C. 9	D. 11 D. 7 D. 6	*Infected by attending No. 16.
16	Lao	Unknown.	1	1	1	1	...	...	1	...	...	...	...	...	...	...	1	...	...	...	D. 1	...	
...	...	TOTAL	19	27	18	28	4	5	16	27	3	4	6	5	0	1	9	20	...	...	...	...	

Venereal diseases are as common in this as in other populous centres of China, both the educated and uneducated seldom taking precautions when exposed. At present most of the treatment is undertaken by semi-trained men who are often not overscrupulous in their methods. Harbin Hospital returns in 1924 show 976 (6.4 %) cases of syphilis and 404 (2.6 %) off gonorrhoea. In 1925 these were respectively 1564 (7.3 %) and 531 (3.5 %). The average percentage for 12 years (1913-25) is 6.9% syphilis and 1.8 gonorrhoea. But these figures probably represent an underestimate.

In summer gastro-intestinal disturbances are not uncommon, but dysentery, enteritis, infantile diarrhoea, etc. are not so frequent as in some regions. A serious outbreak of Cholera, due to importations from Shanghai, occurred in the summer of 1919.

22. PRELIMINARY VITAL STATISTICS.

Until the commencement of our health work, no accurate vital statistics were available. The police figures have only been roughly done with little or no checking. For instance, when making a census only the number of adults was counted, children under 15 years being left out altogether. This at first complicated matters for us, and since we have not sufficient facilities for calculating the *total* population. our sanitary inspectors were instructed to make a survey of groups of families in each ward so as to ascertain the number of children under 15 years in each family. The investigations of just over 1000 families result as follows (Table XIV a and b):

TABLE XIV. a. POPULATION OF 4 WARDS OF PINCHIANG.

(excluding children under 15 years and new Ward V -Taipingchiao- as well as 1400 foreigners).

Ward	*Males*	*Females*	*Total*
I	19128	6247	25375
II	12493	3127	15620
III	27785	7740	35525
IV	12075	6382	18457
Total	71481	23496	94977

TABLE XIV b. SIZE OF FAMILIES IN PINCHIANG AS STUDIED IN OVER 1000 COUPLES.

Ward.	*Husband*	*Wife.*	*Children under 15* *Male.*	*Female.*
I	116	121	50	67
II	295	297	160	160
III	62	62	17	24
IV	560	566	104	121
Total	1033	1046	331	372

H. & W. 2079 Ch. 703 (some husbands have two wives). or about 3 parents to 1 child.

In other words, counting the number of women married to be approximately 15,000 out of a total of 23,496 (since most women in China are married), the number of children in the city is about $\frac{15{,}000 \times 1000}{700}$ or 20,500. This figure added to the total population of 95,000 plus 1400 foreigners would make a grand total of 116,900 or roughly 110,000. Our original estimate was 100,000. The small number of children in this newly developed city of Pinchiang, where family women have only come to reside during the last 6-8 years is significant.

Further, in order to avoid unnecessary mistakes, each sanitary inspector is attached to the main office of the police ward and verifies every case of birth or death reported in addition to other duties. Also no coffin may be sold and no burial take place until a police permit has been issued after inspection by our representative. Rewards of 20 cents each are paid to midwives and persons reporting stillborns and infectious cases. In spite of this care, many loopholes still occur, and strict accuracy cannot be expected for another couple of years.

The statistics are grouped under the following :

a. Mortality acc. to age and sex ....Table XV
b. ,, ,, Ward I-IV .... ,, XVI
c. ,, ,, month .... ,, XVII
d. ,, ,, economic status .... ,, XVIII
e. ,, ,, kind of treatment .... ,, XIX
f. Main causes of death .... ,, XX
g. Classified causes of death .... ,, XXI
h. List of infectious diseases reported .... ,, XXII
i. Births according to month .... ,, XXIII
j. ,, ,, ,, sex .... ,, XXIV
k. ,, ,, ,, midwives employed .... ,, XXV

Table XV. Mortally according to age and sex (Special Death Rate).

Month.	Jan.		Feb.		Mar.		April		May		June		Total		Grand
Years	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	Total
0-1	—	6	2	—	4	—	2	3	2	2	1	4	11	15	26
1-2	2	1	—	1	3	3	3	—	1	—	—	—	9	5	14
2-3	—	1	—	3	2	3	—	5	—	5	3	2	5	19	24
3-4	4	1	1	—	2	2	3	5	4	2	—	1	14	11	25
4-5	2	5	3	4	1	4	3	3	—	1	7	1	16	18	34
5-9	2	3	4	2	1	2	3	3	4	5	1	1	15	16	31
10-14	4	2	9	3	4	2	3	5	2	—	4	4	26	14	40
15-19	5	5	15	4	6	5	5	—	6	8	8	8	45	30	75
20-24	9	7	14	6	6	4	2	3	10	4	6	4	47	28	75
25-29	12	2	14	4	5	7	9	10	8	1	7	4	55	28	83
30-34	14	4	13	4	9	3	8	3	9	5	10	9	63	28	91
35-39	11	6	9	2	10	6	12	4	10	4	13	5	65	27	92
40-44	11	2	7	2	14	5	8	5	7	6	17	3	64	23	87
45-49	11	2	6	1	21	1	8	5	4	—	12	5	72	14	86
50-54	6	—	10	1	6	—	6	3	8	3	6	—	42	7	49
55-59	7	2	2	2	2	3	3	3	6	1	2	3	22	14	36
60-69	4	2	—	2	6	2	5	—	7	—	6	1	28	7	35
70-up	1	—	—	—	6	—	—	—	4	3	2	1	13	4	17
Age unknown	22	13	20	2	21	3	16	8	3	15	7	10	89	51	140
Total	127	64	129	43	129	55	99	68	95	65	112	64	691	359	1050

When the second half yearly returns come in, we shall obtain more accurate figures.

TABLE XVI. MORTALITY ACCORDING TO WARDS (JANUARY-JUNE).

Ward	Actual No. for 6 months.		Increase (†) or decrease (-) from preceding 6 months (Police figures)		Ratio per 1000 inhabitants.		Average.
	Male.	Female.	Male.	Female.	Male.	Female.	Remarks.
I	194	82	†54	†18	20.3	26.2	23.25
II	98	57	†12	- 3	15.7	36.5	26.10
III	251	113	†77	†53	18.0	29.0	23.50
IV	148	107	†65	-12	24.5	33.5	29.00
Total	691	359					or 802 for 1 year (8 per 1000)

Total mortality for 6 months 1050, or 2100 for 1 year, or 21.00 per 1000 population.

TABLE XVII. MORTALITY ACCORDING TO MONTH.

	Actual No.		Total.	
	M.	F.		
January	127	64	191	
February	129	43	172	
March	129	55	184	
April	99	68	167	
May	95	65	160	
June	112	64	176	
Total	691	359	1050 Crude DR per 1000 as above with 21 per 1000.	

TABLE XVIII. MORTALITY ACCORDING TO ECONOMIC STATUS (JANUARY-JUNE).

Very poor, name and address frequently unknown. Pauper.
Poor ......Coolie class, income uncertain.
Fair ....Skilled artisan with average $1-2 income daily.
Rich ......Educated classes, merchants or those with fixed family home and some property.

	Economic status.	No. deaths.	Percentage.	
January	Very poor	42	21.9	
	Poor	44	23.0	
	Fair	72	37.6	
	Rich	33	17.2	
	Total	191	100.0	
February	Very poor	42	24.4	
	Poor	36	20.9	
	Fair	61	35.4	
	Rich	33	19.1	
	Total	172	100.0	
March	Very poor	47	25.5	
	Poor	49	26 :5	
	Fair	50	27.1	
	Rich	38	20.6	
	Total	184	100.0	
April	Very poor	34	23.0	
	Poor	31	21.0	
	Fair	55	37.4	
	Rich	27	18.3	
	Total	147	100.0	
May	Very poor	34	21.2	
	Poor	29	18.1	
	Fair	68	42.5	
	Rich	29	18.1	
	Total	160	100.0	
June	Very poor	38	21.5	
	Poor	31	17.6	
	Fair	70	39.7	
	Rich	37	21.0	
	Total	176	100.0	

TABLE XIX. MORTALITY ACCORDING TO KINDS OF TREATMENT ADOPTED. (JANUARY-JUNE.)

	Kind of Medical treatment adopted	No. Deaths.	Percentage	
January	A. Never seen by any physician	71	37.1	
	B. Seen once or more by old style physicians.	87	45.5	
	C. Seen once or more by western trained phys.	33	17.2	
	Total	191	100.0	
February	A.	50	28.7	
	B.	84	48.7	
	C.	38	22.0	
	Total	172	100.0	
March	A.	67	36.4	
	B.	70	38.0	
	C.	47	25.5	
	Total	184	100.0	
April	A.	69	41.3	
	B.	67	40.1	
	C.	31	18.5	
	Total	167	100.0	
May	A.	65	40.6	
	B.	67	41.8	
	C.	28	17.5	
	Total	160	100.0	
June	A.	71	43.3	
	B	71	43.3	
	C.	34	19.3	
	Total	176	100.0	

TABLE XX. MAIN CAUSES (JANUARY-JUNE).

	Actual Number.							Causes of death per 100.						
	Jan.	Feb.	Mar.	April	May	June	Total.	Jan.	Feb.	Mar.	April	May	June	Ave.
Tuberculos. (all forms)	43	37	32	53	49	50	264	22.5	21.5	17.3	31.7	30.6	28.4	25.3
Other Infections	61	17	53	33	41	56	261	31.9	9.8	2.9	19.8	25.6	31.8	20.3
Accidents & suicides	16	6	7	5	7	7	48	8.4	3.4	3.8	3.0	4.3	3.9	4.4
Surgical cases	3	1	7	8	7	5	31	1.5	0.5	3.8	4.8	4.3	2.8	2.9
Natural (Decrepitude)	6	3	0	4	5	10	28	3.1	1.7	0	2.4	3.1	5.7	3.2
General	62	81	78	64	50	46	381	32.4	47.0	45.3	38.3	31.2	26.1	36.7
Unknown	6	0	7	0	1	2	16	3.1	0	4.3	0	0.5	1.5	2.7
Total	191	172	184	167	160	176	1050	100.	100.	100.	100.	100.	100.	100.

N.B.—It will be seen that the above classification is still far from satisfactory because the junior staff and police have not yet got used to our nomenclature but it will be improved before long.

TABLE XXI. CLASSIFIED CAUSES OF DEATHS (ABRIDGED).

Month	January.		February		March.		April		May.		June.		Total.	
Disease.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.
Small pox	6	1	8	2	6	5	11	7	8	4	8	3	47	22
Cholera	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Typhoid	9	2	7	2	15	1	2	1	7	2	9	3	30	11
Typhus	...	...	...	...	...	...	...	...	...	...	1	...	1	...
Diphtheria ...	...	...	2	2	3	...	1	...	...	1	3	...	9	3
Measles	1	4	5	...	3	...	1	1	1	2	...	1	11	8
Whooping cough	...	...	...	...	1	...	...	...	...	...	...	...	19	5
Influenza	1	11	5	...	4	1	1	...	1	2	3	3	15	17
Tuberculosis. . (all forms)	28	15	30	7	20	12	30	23	27	22	25	25	160	104
Malaria	3	...	...	1	1	...	...	4	1	3	...	3	5	11
Pneumonia (all forms)	2	3	10	2	10	2	4	1	1	1	1	1	28	10
Hydrophobia. .	...	...	1	...	...	...	...	...	...	...	...	...	1	...
Syphilis	4	...	6	...	10	2	5	2	3	2	7	...	35	6
Dysentery	6	5	3	...	...	2	6	2	7	...	14	8	36	17
Acute Diarrhoea	1	...	...	...	1	...	2	...	3	...	3	...	10	...
Respiratory D.	10	2	17	4	10	8	7	4	5	3	4	2	53	23
Scarlatina......	8	11	1	7	8	5	1	1	2	3	3	2	23	29
Digest. sys. ...	10	1	3	...	5	...	4	1	5	...	5	...	32	2
Genito U. S....	2	...	2	...	...	...	1	...	...	...	...	...	5	..
Circulatory S.	1	1	5	2	5	5	2	3	1	4	...	...	14	15
Nervous S. ...	8	...	8	2	8	2	...	7	7	...	6	1	37	12
Women D. ...	...	—	...	2	...	1	...	...	...	3	...	3	...	8
Child birth ...	...	4	...	3	...	8	...	3	...	4	...	7	...	26
Kidney D ...	2	1	5	...	3	...	3	1	4	1	1	...	18	3
Liver D.	2	...	4	...	...	...	...	...	2	...	...	...	8	1

Month	January.		February		March.		April.		May.		June.		Total.	
Diseases.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.
Erysipelas......	...	..	1	1	3	...	3	...	...	1	2	...	5	2
Surgica cases	3		1	...	7	1	6	2	3	4	5	...	25	7
Tetanus.........	...	...	...	...	...	...	2	...	...	...	...	...	2	...
Accid drowning	...	...	...	...		..	...	...	...	1	...	..	...	1
Suicide	4	3	1	1	2	...	...	...	1	1	...	..	8	5
Morph-opium poisoning	1	...	4	...	...	...	5	2	1	...	1	1	12	3
Senility	6	...	...	3	...	...	2	2	4	1	9	1	21	7
Unknown	6	...	...	2	4	3	...	1	1	...	2	...	13	6
Total	127	64	129	43	129	55	99	68	95	65	112	64	691	359

From above we gather the principal diseases in order of frequency to be :

Tuberculosis	Male	160	Female	104	Total	264	or	25.1%
Respiratory Dis.	,,	53	,,	23	,,	76	,,	7.2%
Smallpox	,,	47	,,	22	,,	69	,,	6.6%
Scarlatina	,,	23	,,	29	,,	52	,,	5.0%
Dysentery	,,	36	,,	17	,,	53	,,	5.0%
Nervous Dis.	,,	37	,,	12	,,	49	,,	4.6%
Syphilis	,,	35	,,	6	,,	41	,,	4.0%
Pneumonia	,,	28	,,	10	,,	38	,,	3.6%
Typhoid	,,	30	,,	6	,,	36	,,	3.4%
Kidney Dis.	,,	18	,,	3	,,	21	,,	2.0%

Compare the above with statistics from England and America, where they have collected accurate data for many decades :

Disease	*England & Wales 1920* D.R. per million	Percentage	*New York State 1916* D.R. per million
Cancer	1161	9.4	901
Tuberculosis (all forms)	1131	9.1	1526
Pneumonia	991	8.0	1671 (all forms)
Bronchitis	992	8.0	—
Other resp. dis.	164	1.3	—
Heart Dis.	1413	11.4	—
Dis. of Bl. vess.	1097	8.8	—
Diarr. dis.	303	2.5	512 (infants)
Measles	191	1.5	89
Diphtheria	150	1.2	147
Whooping cough	117	1.0	72
Enteric (typhoid)	14	0.1	58

It will be seen that Tuberculosis is almost three times as common in Harbin as in England and New York, which latter places, however, claim far more deaths from Cancer, Pneumonia and Heart Disease.

TABLE XXII. TOTAL INFECTIOUS DISEASES IN SPECIAL AREA AND PINCHIANG.

Population Special Area ....(S) 150,000
Pinchiang ....(P) 100,000

	Jan.		Feb.		March		April		May		June		Total	
	S	P	S	P	S	P	S	P	S	P	S	P	S	P
Diphtheria	7	2	6	3	21	0	11	3	15	2	2	3	62	13
Scarlet Fever	109	21	108	7	88	14	72	23	88	4	83	1	548	70
Smallpox	1	6	1	7	6	4	15	38	22	27	25	55	70	137
Whooping cough	0	2	0	10	2	9	10	10	0	20	0	5	2	58
Typhoid	4	10	15	3	16	7	17	25	0	0	17	2	69	47
Typhus	0	0	1	0	0	0	1	0	2	1	0	1	4	2
Influenza	0	12	0	5	0	5	1	3	0	0	0	6	0	32
Recurrens	3	0	0	0	0	0	0	0	0	0	0	0	3	0
Dysentery	0	10	0	8	0	2	0	13	1	16	31	55	32	104
Malaria	0	5	0	1	0	6	0	8	0	7	0	28	0	56
Anthrax	0	1	0	0	0	0	0	0	0	0	0	0	0	1
Cholera	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Plague	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	124	57	131	37	133	48	116	129	128	76	158	174	790	521

TABLE XXIII. STATISTICS OF BIRTHS ACCORDING TO MONTHS (JANUARY-JUNE).

(Excluding stillborns)

Month.	Ward I.	Ward II.	Ward III.	Ward IV.	Total.	Remarks
January	10	14	33	16	73	
February	9	11	27	15	62	
March	23	10	28	14	75	
April	10	13	30	17	70	
May	7	11	27	15	60	
June	8	13	25	15	61	
Total for 6 months ...	67	72	170	92	401	or 802 for 1 year *i.e.* 8 per 1000

N.B.—Above figures are obviously inaccurate and should be at least double; in other words, the minimum birth rate should be 16 per 1000.

TABLE XXIV. STATISTICS OF BIRTHS ACCORDING TO SEX (JAN-JUNE).

Month.	Male.	Female.	Total.	Ratio of Male to 100 F. births.
January	43	30	73	143.3
February	34	28	62	121.4
March	46	29	75	158.6
April	35	35	70	100.0
May	33	27	60	122.2
June	34	27	61	125.9

TABLE XXV. STATISTICS OF BIRTHS ACCORDING TO CLASSES OF MIDWIVES EMPLOYED.

Month.	Types Midwife.	No. births.	Percentage.
January	Non-licensed	50	69.3
	Old type	18	24.6
	New type	5	6.8
	Total	73	100.0
February	Non-licensed	32	51.6
	Old type	24	38.7
	New type	6	9.5
	Total	62	100.0
March	Non-licensed	43	58.6
	Old type	14	18.6
	New type	18	24.0
	Total	175	100.0
April	Non-licensed	31	44.8
	Old type	30	42.8
	New type	9	12.8
	Total	70	100.0
May	Non-licensed	42	70.0
	Old type	16	26.6
	New type	2	33.3
	Total	60	100.0
June	Non-licensed	24	39.3
	Old type	35	57.3
	New type	12	19.6
	Total	61	100.0

23. Laboratory and Museum.

One of the most important additions to the Plague Prevention Hospital is a new laboratory completed in September 1924. This is a two-storied rectangular building, 110 ft. long by 40 ft. wide, equipped with all modern contrivances for research and routine work. The following are the principal divisions :

a. *Research.* Investigation of plague, mainly pneumonic, marmots and other rodents. Investigation of cholera, scarlatina, helminths and other parasites.

b. *Diagnosis.* The laboratory is equipped for clinical and public health requirements, such as are usually found in a modern institute. Wassermann tests are regularly performed.

c. *Serum and vaccine manufacture.* Here vaccines for plague and cholera are made for mass injections whenever needed. For over a year we have also manufactured scarlet fever toxin and anti-toxin after Dick and Dochez methods. We give anti-rabic treatment when needed. All the commoner vaccines, e.g. typhoid, are at hand.

d. *Pathology.* For years we have served as the central organ for histological examination of specimens for the city and local practitioners. This year we have been invited to perform postmortems for the Municipal hospital.

e. Analysis. Analyses are performed for drugs, food, water, milk, patent medicines, anti-opium remedies, poisons, etc.

f. *Library and Museum.* We have perhaps the most complete medical and scientific library in North Manchuria. It is open to physicians and all *bona-fide* readers. The pneumonic plague department is unrivalled. The museum contains a useful display of public health models and charts, besides strictly medical specimens and exhibits.

g. *Sanitary consultations.* Requests come to us from all parts of China for advice regarding various aspects of sanitary work. Attention has already been drawn to the out-of-date ideas prevalent even among medical and scientific persons regarding the true requirements of health. This consultative division is at the disposal of all who desire fuller knowledge, practical as well as theoretical. Among other things, we hope to instil hygienic ideas among the masses, with particular reference to ophthalmia neonatorum, trachoma, child hygiene, school hygiene, public health nursing, vaccination, and the like, so as to attain a minimum death rate for the city and neighbourhood.

24. SUMMARY AND CONCLUSIONS.

We have come to the end of our Report of this Preliminary Health Survey of Pinchiang. We are aware of its incompleteness and even of its insufficient accuracy. But it has been merely the experimental work of six months accomplished by a new small department of our Plague Prevention Service, without extra personnel or additional funds. The six sanitary inspectors are paid by us, and their total salaries with allowances total $260 per month. The policemen belong to the regular city force. With a budget of $800 per month we could expand the work, obtain more accurate statistics and through consistent educational propaganda and district-nursing check the infantile mortality, reduce the ravages of tuberculosis, scarlet fever and other important communicable diseases, as well as protect the mothers. Our laboratory and trained medical officers will offer every facility to the public in this new mission.

For several years we have considered the feasibility of getting the authorities for public health purposes to impose a five percent stamp tax on all patent medicines, which because of intensive advertising campaigns seem to have 'taken on' and mulcted the gullible public or tens of millions of dollars yearly. In this, we can easily copy the policy of Great Britain and Japan. We hope that before long a real business-like policy in health administration for China will be adopted by some far-sighted legislator, so as to produce the happy results accruing from the prevention of diseases, to which every civilised modern country is entitled. In the meantime, let us recapitulate some of the more important results of our survey.

1. Pinchiang with a population of just over 100,000 has (from the figures available) a birth-rate of 8 per 1000. This is, however, by far an under-estimate, due to insufficient reporting. A more exact estimate would be double this, namely 16. In Peking (eastern ward with 58,605 population) the birth rate is 27 per 1000.

2. The crude death rate of Pinchiang during the six months under survey is 21 per 1000 as compared with 22.2 for the eastern ward of Peking. A fuller comparison with other big cities may be instructive (League of Nations Epidem. Rep. R. E. 88, Sept. 1925—April 1926):

City	*Population*	*Death Rate per 1000*
Sydney	1,012,000	8.9
London	4,577,000	12.2
Berlin	4,014,000	12.5
Chicago	2,886,000	14.2
New York	5,928,000	14.3
Leningrad	1,071,000	16.6
Paris	2,906,000	18.1
Edinburgh	425,000	18.4

City	*Population*	*Death Rate per 1000*
Singapore	496,000	20.1
Tokio	2,100,000	23.1
Bombay	1,279,000	28.0
Calcutta	1,077,000	44.0
Madras	527,000	45.9

3. Of communicable diseases, tuberculosis, smallpox, dysentery, scarlet fever, and whooping cough claim most deaths in the order named. The variety of scarlet fever encountered is exceedingly virulent, killing among 16 families investigated over 50% male and 70 female children exposed. Dick tests show a high prevalence of positive reactions (86%) among children aged 3-6 years. Even among adults the percentage averages 40 or over.

4. Trachoma is common among 1137 male school pupils examined (30.5%).

5. Medical practice is not properly controlled in this city, anyone with a smattering of knowledge being allowed to try his or her skill upon the population on application to the Police. In this respect other cities sin as well, and the medical profession of China must stir themselves up to have these abuses remedied.

6. Venereal diseases are prevalent in Harbin, but not more excessive than those of other cities. A systematic educational campaign as to prophylaxis and early treatment as well as properly conducted clinics will do much to diminish their incidence.

7. So far, nothing has been done in the way of maternal or infantile hygiene, but it is trusted that our newly established nursing college may supply the necessary personnel to deal with this matter during the next few years.

LIN CHIA SWEE AND WU LIEN TEH.

THE PROBLEM OF VENEREAL DISEASES IN CHINA.

TABLE OF CONTENTS.

A. INTRODUCTION.

Like most countries of the world China is confronted with the serious problem of venereal diseases. It may be said without fear of contradiction that syphilis at least can only be traced in this country to comparatively recent times. Such an eminent authority as K. Dohi (Dermatological Institute of the Tokyo Imperial University) says that syphilis was imported from the west some time in the 16th century. Our Chinese records prove that it was unheard of in China until the middle of the 16th century, when it was introduced into Canton by Portuguese from India. Syphilis was frequently mentioned in the latter part of the Ming Dynasty (1367-1644), often in an accurate and illuminative manner, and in one interesting monograph written in 1631 the various manifestations and hereditary transmission of the disease are mentioned in full detail.

It was unfortunate from the preventive standpoint that for nearly 100 years after the introduction of western medicine into China venereal disease was, as it were, avoided by responsible teachers and it was only within recent times, say the last 15 years, that serious attention has been centered upon the two widespread sexual diseases, syphilis and gonorrhoea.

B. INFORMATION ON THE PREVALENCE OF VENEREAL DISEASES IN CHINA.

I have for a number of years been interested in the public health aspects of this problem in China and studied particularly its connection with prostitution which in this country may be traced to a period even earlier than the hectic days of the Roman Empire. In order to classify the information available regarding the prevalence of venereal diseases in China I have arranged it in five groups :

a. General statements of medical practitioners as to their frequency.

b. Incidence of venereal diseases among patients admitted or treated in hospitals, etc. Frequency of syphilitic changes found at *post-mortem*.

c. Special inquiries as to the frequency of venereal infection (past and present) among patients.

d. Routine Wassermann Reactions among patients and groups of population.

e. Incidence of venereal diseases according to occupation.

a. General statements of medical practitioners as to the frequency of venereal diseases.

Obviously such statements can give only a rough idea of the frequency of venereal diseases, but attention has to be paid to the critical judgement of various authorities. Table I comprises data collected from cities

in 8 provinces as well as Hongkong and Formosa which are largely inhabited by Chinese.

The figures show that venereal diseases are rampant everywhere, often to an alarming extent, as much as 50-60 percent of the adult population being affected.

b. *Incidence of venereal diseases among patients admitted or treated in hospitals, etc. Frequency of syphilitic changes found at post-mortem.*

For these, we have figures from Hongkong (1912-24), Shanghai (1912-25 and 1870-1925) and Manchuria (1913-1925).

In Hongkong the incidence of Syphilis varies from 1.5-3.2% of all admissions into hospitals; in the mortuary the figure is 5%, whilst gonorrhoea claims 0.7-2.5%.

The Shantung Road Hospital, Shanghai, records an average of 6.6% of all admissions between 1870-1925. This Hospital also records 3.4% male as compared to 2.2% female sufferers from syphilis among out-patients.

Our Plague Prevention Service Hospitals numbering five in North Manchuria record 2.9 to 8.1% (average 6.4%) of Syphilis, whilst Newchwang claims 13.5% of syphilis and 14.8% of gonorrhoea.

The figures collected above probably do not present a high enough incidence of venereal diseases, but a minimum of same for the following reasons :

i. As far as Inpatients are concerned, the hospitals adopt different policies regarding admittance of venereal diseases; often they refuse admission altogether.

ii. Only a portion of patients seek the aid of western hospitals.

iii. Only manifest cases are recorded, many of the venereal disease cases being hidden under other headings, like rheumatic, nervous, heart, women's diseases, etc.

iv. Traces of former infection may only be accurately detected by such tests as Wassermann.

v. Where no such traces are left, careful investigation would reveal history of former infection.

c. *Special enquiries as to the frequency of venereal diseases (past and present) among patients of hospitals.*

Only one such enquiry is on record (Lennox, China Medical Jl., 1919, p. 326). He says :

Among 4000 married men (poor and middle class)
22.2% admitted having had gonorrhoea,
6.9% ,, ,, ,, syphilis,
3.9% ,, ,, ,, both.

d. Routine Wassermann Reactions.

Routine Wassermann Reactions as collected at Soochow. Peking and Shanghai are tabulated in Table Va. The figures vary widely owing to different interpretations by various workers, but it may be said that—as far as our limited figures go—the average percentage of 17.3 follows closely the published records of Great Britain (18.2) and U.S.A. (20.1). See table Va.

e. Incidence of venereal disease according to occupation.

In this connection records from Soochow, Peking (3) and Shanghai have been consulted. They show much variation among the different occupations in different localities, but generally it may be said the incidence is highest among soldiers and police, and lowest among professional people. Business men come rather high, whilst farmers and labourers seem to occupy an intermediate position. In order of scale, the figures show the following :—Soldiers and police (over 35%), Business (31.8), unclassed occupation (21.1), farmers (16.8) labourers (15.3), students (13) and professional (7.1). Average 19.5.

C. PROSTITUTION IN CERTAIN CITIES.

In addition to the above a table (Table VIII) deals with the numbers of prostitutes in certain localities. Here it may be interesting to mention that of all cities in China the two (Antung and Taheiho) where there is regular weekly medical inspection of brothel inmates are both situated in Manchuria.

In Canton the proportion of prostitutes to population is 1 :837; in Shanghai it is 1 :147; in Harbin 1 :82; in Taheiho 1 :138; and in Newchwang 1 :113. The abnormally high percentage in Harbin, an important city with a large floating population, is significant.

D. SHORT SUMMARY OF MEASURES TAKEN IN SOME COUNTRIES.

It would require too much time if I were to describe in detail the various methods that have been introduced or are being introduced in different parts of the world for the prevention and control of venereal diseases. Suffice it to say that each country with its peculiar national traits proposes to deal with the problem in its own way. For instance reformers in Great Britain with its high moral and religious sense are divided into two main camps, advocating respectively :

(*a*) Early treatment (that is, disinfection immediately after intercourse at so-called treatment centers) and

(*b*) Prophylaxis (where disinfectants such as 1 :3 calomel ointment are employed previous to intercourse). But in view of the frequent unwillingness or inability on the part of individuals to resort to precautions, public opinion in that country is gradually coming round to the view that some sort of compulsion in

prophylaxis and notification is necessary. As late as June 16th, 1926, Mr. Basil Peto, M.P., presented a Venereal Diseases Bill 1926 before Parliament to permit the sale by chemists of disinfectants for protection against venereal diseases. In his speech he quoted several medical authorities to prove that early prophylaxis means a lower incidence of venereal diseases. Thus, in one military camp, out of 4400 men exposed to infection only 13 cases of infection resulted. In the Naval Gunnery School at Portsmouth between 1918-20, 923 bottles of 1 : 1,000 Permanganate solution were supplied to men exposed to infection, and only one case of disease resulted. At the Royal Artillery Barracks at Portsmouth in 1917, 3750 soldiers received early disinfection with only five casualties. There is no reason why similar beneficial results may not be expected amongst the civil population. Statistics show that a large proportion of paralysis, malformation, mental deficiency, insanity, epilepsy and blindness affecting greatly the efficiency of the population is traceable to syphilis and gonorrhoea. For the treatment of patients suffering directly or indirectly from these two diseases the Government spent at least £600,000 in the year 1924-25. In Great Britain the Venereal Diseases Act of 1917 is still in force, by which treatment of venereal diseases is prohibited to all except duly qualified medical practitioners. In the New Venereal Diseases Bill of 1926 it is proposed to extend certain rights to chemists as well as doctors in the matter of prophylaxis. Dr. A. W. Pope has suggested the following measures against venereal diseases for Great Britain (Lancet, June 26th, 1926) :

a. Duty of Person Infected.—(1) Every person suffering from any form of venereal disease as soon as he is aware or has reason to believe that he is suffering from such disease, shall forthwith consult a medical adviser with respect thereto, and shall furnish to him his correct name and address and place himself under his treatment. (2) Every such person shall continue to attend or be attended by his medical adviser, and to follow his advice and treatment until he is deemed from infection. (Provision to be made for change of medical adviser and for routine procedure in case of neglect to continue treatment.) (3) No person shall knowingly or wilfully infect any other person with venereal disease or do not permit any act likely to lead to such infection.

b. Duty of Parent or Guardian.—Every parent, guardian or person in charge of child (under 16 years of age) or mental defective suffering from any form of venereal disease, and who knows that such child or defective is suffering from such disease, shall cause the child or defective to be treated and continue treatment for such disease by a medical adviser.

c. Penalties.—Section 1 (3) of the Public Health Act, 1896, provides that if any person wilfully neglects or refuses to obey the execu-

tion of any regulation under Section 130 of the Public Health Act, 1875, he shall be liable to a penalty not exceeding £100 and in the case of continuing the offence of a further penalty of £50 per day.

d. *Duties of Medical Practitioner.*—(1) The doctor shall direct the patient's attention to the infectious character of the disease, and to the necessity of continuing treatment until free from liability to infect, and to the penalties prescribed. (2) To arrange for transfer to another medical adviser when the patient so desires. (3) When a patient discontinues medical treatment without adequate reason, the medical adviser will forward his name and address to the medical officer of health. In any case where a fee is not paid by the patient to the doctor, the provision for such payment shall be made on the lines which the Ministry have already authorised in Liverpool in regard to the domiciliary treatment of non-insured tuberculous persons. Suitable forms shall be provided for the use of medical practitioners intimating the obligations upon patients—arrangements for transfer when necessary—and forms of notice to the medical officer of health as to acceptance of a patient by the practitioner, and when necessary, his non-attendance. Drugs specially necessary for treatment shall be provided free of charge to medical men as hitherto. Ordinary prescriptions shall be paid for as in the scheme for domiciliary treatment of tuberculosis.

c. *Duty of Medical Officer of Health.*—The medical officer of health, on receipt of a notice from the medical adviser in regard to any patient, shall make inquiries from the person named as to the reason for discontinuance of treatment, and unless satisfied shall cause an information to be laid in a court of summary jurisdiction.

Turning to *France* we find that the problem of venereal diseases has become so serious that very radical laws are proposed, dealing especially with syphilis. These include compulsory treatment by physicians, notification by physicians of the patient's condition to the proper authorities as to the source of infection as well as the stage of the disease, with heavy fines in case of non-observance.

In *America* each of the 48 States of the Union has its own laws against venereal diseases. Even in the matter of prostitution they vary considerably, some cities regulating the vice whilst the majority prohibiting it altogether. Thanks to the force of public opinion it is possible that before very long the few red-light districts still existing will be abolished, but this does not mean that venereal diseases will be entirely stamped out. In Chicago large numbers of women are every morning hauled up before the Court for practising illicit prostitution. Two women physicians are employed to examine the delinquents and if found diseased they are sent to a special ward in the Municipal Hospital. In the city of Detroit one of the most important clinics is that presided by Dr. R. S. Dixon, a keen man with initiative who, although the law nominally prohibits prostitution, manages to have hundreds of

women visiting him daily at his office to voluntarily register themselves and receive treatment when diseased. Dr. Dixon actually quizzes them over their methods of preventing infection in the course of their occupation and gives demonstrations on the proper technique to be adopted. In order to aid local authorities and social organisations in their anti-venereal campaign the U. S. Public Health Service has published an interesting booklet of 60 pages for the guidance of community leaders. There are three major chapters :

I. Educational Measures on :

1. Arousing the community to the seriousness of venereal diseases.
2. Centering attention on the communicable nature of gonorrhoea and syphilis.
3. Emphasizing importance of prevention.
4. Education against the danger and degradation of prostitution.
5. Such education to reach all classes of the population.

For broadcasting information, educational methods are recommended in the form of pamphlets, books, lectures, exhibits, lantern slides, motion pictures, radio talks, etc.

II. Medical Measures, emphasizing particularly :

1. Treatment should be free or for a nominal fee.
2. Treatment should be easy of reach.
3. Treatment should be prompt and continuous.
4. Treatment should be scientific.

For carrying these out there are recommended V.D. Clinics, hospital treatment, venereal diseases control ordinances, exposing quacks and quack medicines, and extensive use of laboratory facilities.

III. Legal Measures by means of :

1. Laws prohibiting prostitution,
2. Indirect attack on prostitution, such as injunction of property.
3. Elimination of clandestine prostitution, such as control of rooming houses and hotels, licensing public dance halls, licensing taxicabs.
4. Disposition of prostitutes, e.g. treating them when sick, giving them work, etc.
5. Compulsory control of ophthalmia neonatorum.
6. Marriage reform, e.g. requiring medical certificates from contracting parties.

E. DISCUSSION OF MEASURES POSSIBLE AT PRESENT IN CHINA.

How far are these more or less ideal laws applicable to China at the present moment? In the course of my experience I have come

across women-teachers who demand certificates from me guaranteeing the good health of their proposed husbands before they are willing to enter into matrimony. On the other hand I have seen well educated families who persist in uniting their beloved daughters to obviously diseased young men in spite of medical advice. The poor as a rule have little or no choice though it must be said that the majority of country peasants of whom the bulk of China's population consists, are free from venereal diseases.

It will be a long time before prostitution can be abolished in China as a result of public agitation and sentiment.

Almost every Chinese city now has a few western trained practitioners whose main income is derived from the injection of Salvarsan (or substitute) solutions into their patients. Harbin alone with its 300,000 inhabitants has over 200 such "hospitals." It pays such practitioners better to charge $20-30 for each injection than to advise on prophylaxis bringing small monetary returns. In the latter case the packet costs only 30-50 cents and does not immediately advertise his skill in treatment.

Nation-wide health education is absolutely necessary if the present alarming incidence of venereal diseases is to be diminished. I would advise that the medical profession of China join in this crusade against ignorance, and advocate without hesitation in homes, college institutions and hospitals, not only the need of control of the sexual appetite but also efficient prophylaxis. May I summarise these proposals?

F. RECOMMENDATIONS.

(1) Emphasize prevention of sexual diseases as well as other aspects of health education, such as infant welfare, infectious diseases, tuberculosis, etc.

(2) Prepare and distribute popular health tracts on venereal diseases, and utilise all reliable agencies for the dissemination of knowledge.

(3) Invite co-operation of mission and lay teachers in this publicity work.

(4) Prepare and sell at cheap prices prophylactics of proved value, such as calomel cream, permanganate, etc.

(5) Provide as cheap treatment as possible for all forms of venereal disease in hospitals, so that poor and rich may be equally benefitted.

For this purpose, the location and time of the clinics should be adopted to individual needs.

TABLE I.

Locality.	Reference.	Year.	Incidence of V.D. Remarks.
Antung (Manchuria)	Larsen, Ch. M. Jl. 1919, p. 280.	1917-18	"It seems as if at least half the population is infected."
Canton (Kwangtung)	Reynolds, ibid., 1917, p. 225. Li Ting-An, Nat. Med. Jl., 1925, p. 324.	1915-16 1924	Both syphilis and gonorrhoea extremely prevalent. Syphilis is one of the most important causes of morbidity and mortality.
Hainan (Kwangtung)	Bercovitz, ibid., 1924, p. 788.	1924	Syphilis one of he commonest diseases. Estimates 50-60% of population affected.
Pakhoi (Kwangtung)	Baronsfeather, ibid., 1917, p. 443.	1916	Syphilis and gonorrhoea among the most common diseases.
Yeungkong (Kwangtung)	Debson ibid., 1911, p. 71.		Syphilis: "I am compelled to believe, that seven-tenths of all patients present a lowered vitality through this venereal disease."
Changsha (Hunan)	Jen, Ch. Med. Jl., 1912, p. 359. Hume, ibid., 1917, p. 309.	1911 1914-15	"Tuberculosis and syphilis still heading the list of diseases prevalent among the Chinese......" V.D. very common.
Hunan	Pakes, Ch. Med. Jl., 1911, p. 362.		"The extraordinary prevalence of s. in all its stages and manifestations is enough to stagger one." Gonorrhoea not so often seen.
Chinkiang (Kiangsu)	Bradshaw, ibid., 1919, p. 184 and 1920, p. 86.	1917-18 1918-19	V.D. fairly common.
Soochow (Kiangsu)	Russell and Park, ibid., 1918, p. 69.	1916	See special table. V.D. appear to be on the increase.
Shanghai (Kiangsu)	Hou, Nat. Med. Jl., 1925, p. 27.	1923	See special table. Speaks of steady increase of V.D.
Chungking (Szechuen)	Post, Ch. Med. Jl. 1917, p. 260.	1913-14	In the German Poliklinik there were 521 cases of syphilis (including 30 congenital) and 176 cases of gonorrhoea among 4787 total cases (10.9 & 3.5% resp.)
Formosa	Maxwell, ibid., 1915, p. 28.	1913	"Venereal disease is rampant ...... Syphilis is a commoner and much more severe disease than is now ordinarily met with in England. Amount of acquired syphilis in children is simply appalling..."

Locality.	Reference.	Year.	Incidence of V.D. Remarks.
Hongkong	Medical Reports.		See special table. Increase in numbers of patients 1921-23. In 1924 no further increase.
Ichang (Hupeh)	Borthwick, Ch. Med. Jl. 1917, p. 31.	1914-15	"Day in and day out, we are brought face to face with V.D."
	Graham, ibid., 1918, p. 70.	1916-17	"Patients with V.D. are seen in great numbers..."
	Ibid., 1919, p. 183.	1917-18	"Venereal diseases have been even more in evidence than formerly owing to the large number of troops in the district......"
Kansu	King, ibid., 1925, p. 20.		Syphilis "is widespread. Some of the worst cases come from among the Thibetans..."
Tengyueh (Yunnan)	Ram Lall Sircar, Ch. Med. Jl., 1912, p. 247.	1912	V.D. among the most prevalent ones.
	Chose, ibid., 1920, p. 87.	1918-19	
Wenchow (Chekiang)	Stedford, ibid., 1916, p. 338.	1914	Syphilis "extremely common."

TABLE II. SYPHILIS AND GONORRHOEA ADMISSION. HONGKONG HOSPITALS.

Date.	Civil Hosp.				Goal Hosp.				Kowloon Disp.				Tung Wa Hosp.				Victoria Mort.				Kowloon Mort.				Total			
	Syph. No.	%	Gon. No.	%	Syph. No.	%	Gon. No.	%	Syph. No.	%	Gon. No.	%	Syph. No.	%	Gon. No.	%	Syph. No.	%	Gon. No.	%	Syph. No.	%	Gon. No.	%	Syph. No.	%	Gon. No.	%
1912	75	2.8	50	1.9	5	0.4	1	0.1	74	2.6	138	4.9	195	4.7	29	0.7	21	0.8	...	...	7	0.5	...	...	377	2.6	218	2.0
1913	70	2.6	51	1.9	8	0.3	2	0.1	70	2.8	80	3.2	152	3.2	78	1.7	21	0.8	...	..	...	0.	...	...	443	2.9	211	2.0
1914	74	2.8	56	2.1	10	2.7	2	0.4	97	3.3	102	3.5	141	3.1	49	1.7	101	4.5	...	...	1	0.1	...	...	424	3.0	209	2.0
1915	75	2.5	49	1.6	4	1.7	2	0.5	290	5.4	230	4.3	87	1.9	36	0.8	234	10.6	...	..	6	0.6	...	...	696	4.2	317	2.4
1916	98	3.3	46	1.5	2	0.8	1	0.4	222	3.1	284	4.0	128	2.4	21	0.4	296	8.0	...	...	5	0.4	...	...	751	3.6	352	2.3
1917	130	4.0	54	1.7	3	1.8	2	1.1	190	2.1	353	3.8	117	2.3	36	0.7	251	8.0	...	...	2	0.1	...	..	693	3.1	445	2.5
1918	86	2.4	65	1.8	6	2.0	0	0	252	1.9	202	1.5	105	1.7	48	0.8	357	8.7	...	...	4	0.2	...	...	810	2.7	315	1.3
1919	125	3.2	125	3.2	8	?	0	0	216	1.6	260	2.0	74	1.1	18	0.3	119	3.8	...	...	5	0.3	...	...	547	1.9	403	1.7
1920	144	3.1	176	3.8	10	3.4	2	0.8	205	1.9	249	2.3	158	2.2	29	0.4	317	8.2	...	...	9	0.6	...	...	843	3.0	456	2.0
1921	217	4.6	149	3.1	7	3.0	2	0.8	221	1.4	160	1.0	249	3.6	42	0.6	152	4.4	...	...	14	1.0	...	..	860	2.7	353	1.1
1922	172	4.0	135	3.1	7	1.0	9	2.5	264	1.1	215	0.9	349	4.3	61	0.7	54	1.4	...	...	29	1.4	...	...	875	2.1	420	1.2
1923	177	3.3	113	2.1	6	2.0	2	0.7	353	2.4	96	0.7	575	5.7	72	0.7	65	1.3	...	...	70	3.1	...	...	1246	3.3	283	0.9
1924	169	2.8	125	2.1	1	0.2	5	1.2	517	2.6	138	0.7	427	4.5	57	0.6	99	2.5	...	...	113	4.3	...	...	1326	3.1	325	0.9
Average %	...	3.2	...	2.3	...	1.5	...	0.8	...	2.5	...	2.5	...	3.1	...	0.6	..	5.0	...	...	...	1.0	...	...	...	3.0	...	1.7

TABLE IIIA. SYPHILIS AND GONORRHOEA AND CHANCROID ADMISSIONS, SHANGHAI HOSP.

Date	Isolation Hosp. (Chinese cases only)						Goal Hosp. (All cases)						Police Hospital. (Chinese cases only)						Total.					
	Syph. No.	%	Gon. No.	%	Ch. No.	%	Syph No	%	Gon. No.	%	Ch. No.	%	Syph. No.	%	Gon. No.	%	Ch. No.	%	Syph. No.	%	Gon No.	%	Ch No.	%
1912	14	1.3	292	28.3	15	1.4	0	0	94	12.0	77	9.7	16	2 1	80	10.7	80	10.8	30	1.2	466	18.1	173	6.7
1913	0	0	267	28.5	8	0.9	15	2.9	49	9.3	36	6.9	19	2.4	57	7.2	69	8.9	34	1.5	373	16.7	119	5 3
1914	0	0	204	20.8	1	0.1	9	0.7	107	7.9	94	6.9	33	3.5	84	8.8	82	8.6	42	1.2	395	12.0	177	5.4
1915	2	0 2	236	25.3	6	0.6	1	0.1	104	6.1	46	2.7	12	1.1	76	7.4	75	7.3	15	0.4	416	11.4	127	3.5
1916	1	0.1	306	44.2	13	1.9	4	0.2	77	4.6	114	6.8	9	1.0	37	4.0	29	3.1	14	0.4	420	12.7	156	4.7
1917	5	0 6	287	35.1	3	0.4	4	0.2	103	4.0	166	6.6	9	1.1	32	4.0	20	2.5	18	0.4	422	10.0	189	4 5
1918	2	0.4	146	26.2	4	0.7	20	1.0	78	3.8	180	8.8	10	1.1	35	3.9	18	2.0	32	0.9	259	7.4	202	5.7
1919	10	1.7	110	19.1	3	0.5	29	1.5	91	4.8	191	10.1	8	0.9	24	2.8	11	1.3	47	1.4	225	6.8	205	6.2
1920	2	0.4	53	11.4	1	0.2	27	1.0	132	5.2	140	5.5	11	1.3	26	3.0	12	1.4	40	1.0	211	5.4	153	3.9
1921	—	—	—	—	—	—	146	9.3	126	8.0	76	4.8	52	6.4	27	3.3	8	1.0	198	8.3	153	6.4	84	3.5
1922	—	—	—	—	—	—	71	2.8	240	9.3	130	5.0	50	5.3	35	3.7	14	1.5	121	3.4	275	7.8	144	4.1
1923	—	—	—	—	—	—	121	4.8	348	13.8	147	5 8	184	18.7	34	3.4	10	1.0	305	8.7	382	10.9	157	4.5
1924	—	—	—	—	—	—	115	3.8	378	12.4	165	5.4	46	5.3	37	4.2	10	1.1	161	4.1	415	10.5	175	4.4
1925	—	—	—	—	—	—	87	2.7	393	12.4	140	4.4	17	1.7	41	4.1	10	1.0	104	2.5	434	10.4	150	3.6
Average %		0.7		26.5		0.7		2.4		8.1		6.4		3.7		5.0		3.7		2.5		10.5		4.7

TABLE IIIb. V. D. CASES IN SHANGHAI HOSPITALS.

Years.	General Hospital (almost exclusively foreigners).		Shantung Road Hospital (Chinese).			St. Luke's	
	No.	%	No.	%	Remarks :	No.	%
1865-69	450	19.2					
1870-74	289	16.5	3329	5.3	Total new cases.		
1875-79	232	14.1	3869	5.2	,, ,, ,,		
1880-84	214	10.0	4511	5.9	Total new cases. No figures available for 1883.		
1885-89	203	8.7	5310	5.7	Total new cases. No figures available for 1885.		
1890-94	242	8.3	5627	5.9	Total new cases. No figures available for 1893.		
1895-99	402	9.3	24004	6.9	Total cases (old and new).		
1900-04	616	9.3	35251	7.6	Total cases (old and new).		
1905-09	602	7.9	345	5.4	Only in-patients.		
1910-14	599	7.5	458	5.7	Only in-patients.		
1915-19	507	6.6	385	4.2	Only in-patients.	1919 195	8.4
1920-22	591	8.2	262	4.9	Only in-patients.		
1923	—	—	2555	6.3	Only out-patients (new cases)	652	?
1924	—	—	3023	6.2	Total new cases.		
1925	—	—	2642	6.8	Total new cases.		
Total	4947	9.1	91571	6.6			

TABLE IIIc. SHANTUNG ROAD HOSPITAL OUT-PATIENTS SHANGHAI.

SYPHILIS.

Year.	Male		Female		Total	
	No.	%	No.	%	No.	%
1923	952	3.1	287	3.0	1239	3.0
1924	1034	3.1	261	2.1	1295	2.8
1925	1033	4.1	163	1.5	1196	3.3
Total	3019	3.4	711	2.2	3730	3.0

GONORRHOEA.

Year.	Male		Female		Total	
	No.	%	No.	%	No.	%
1923	826	2.6	38	0.4	864	2.1
1924	997	3.0	91	0.7	1088	2.4
1925	913	3.6	54	0.5	967	2.7
Total	2736	3.0	183	0.5	2919	2.4

CHANCROID.

Year.	Male		Female		Total	
	No.	%	No.	%	No.	%
1923	428	1.4	24	0.2	542	1.1
1924	470	1.4	25	0.2	495	1.1
1925	355	1.5	17	0.2	372	1.0
Total	1253	1.4	66	0.2	1319	1.1

TABLE IV. SYPHILIS AND GONORRHOEA, PLAGUE PREVENTION HOSPITALS, MANCHURIA.

Date.	Harbin.				Taheiho				Sansing.				Lahasusu.				Manchouli.				Total.				% of V. D. of Newchwang Hospital.	
	Syph. No.	%	Gon. No.	%	Syph No.	%	Gon. No.	%	Syph. No.	%	Gon. No.	%	Syph. No.	%	Gon. No.	%	Syph. No.	%	Gon. No.	%	Syph. No.	%	Gon. No.	%	Syph.	Gon.
1913	639	5.6	114	1.0	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	639	5.6	114	1.0		
1914	1273	7.1	203	1.1	131	11.6	36	3.2	65	1.4	81	1.7	—	—	—	—	—	—	—	—	1469	6.2	320	1.3		
1915	1399	8.9	273	1.7	137	6.9	31	1.6	191	9.1	99	5.2	42	3.7	18	1.6	—	—	—	—	1769	8.5	421	2.0		
1916	1334	11.5	149	1.3	108	4.4	62	2.5	53	1.7	45	1.4	4	3.8	17	1.6	—	—	—	—	1535	8.4	273	1.5		
1917	746	7.0	241	2.2	309	8.1	309	8.1	29	0.7	48	1.2	40	4.2	7	0.7	—	—	—	—	1124	5.7	605	3.1		
1918	387	4.0	104	1.1	505	7.7	339	5.2	70	1.8	55	1.4	45	7.2	12	1.9	—	—	—	—	1007	4.9	510	2.4		
1919	332	3.7	135	1.5	583	8.1	372	5.2	117	3.8	27	0.9	24	6.9	9	2.6	—	—	—	—	1056	5.4	543	2.8		
1920	755	8.7	297	3.4	821	11.6	307	4.3	185	4.5	45	1.1	79	4.3	30	1.6	—	—	—	—	1840	8.5	679	3.1	10.0	12
1921	343	7.9	52	1.2	452	9.3	290	6.0	154	1.3	50	1.4	187	9.1	109	5.3	—	—	—	—	1136	7.6	501	3.4	12.0	15
1922	583	6.6	134	1.5	128	4.4	43	1.5	91	2.1	51	1.2	90	6.1	13	0.9	175	8.0	171	7.9	1067	5.4	412	2.1	21.0	20
1923	772	4.6	428	2.6	150	4 0	65	1.7	78	1.4	47	0.9	19	1.4	0	0	484	11.9	106	4.3	1503	5.1	646	2.1	20.0	18
1924	976	6 4	404	2.6	109	3.7	45	1.5	65	1.5	13	0.3	57	3 1	18	1.0	182	8.0	126	5.5	1389	5.2	606	2.3	10.0	14
1925	1564	7.3	531	2.5	77	3 0	39	1.5	114	2.8	37	0.9	81	4.9	58	3.5	174	5.7	155	5.1	2010	6.1	820	2.5	8.0	10
Average %		6.9		1.8		6.9		3.5		2.9		1.5		5.0		1.9		8.1		5.7		6.4		2.3	13.5	14.8

TABLE VA. INCIDENCE OF WASSERMANN POSITIVES AMONG CERTAIN GROUPS.

Locality.	Reference.	Category of exd.	Male.		Female.		Total.		Married.		Single.		Age.													
			No. exd	% +	No. exd	% +	No. exd.	% +	No. exd.	% +	No. exd.	% +	No. exd.	% +	No exd.	% +	No. exd.	% +	No. xd.	% +	No. exd.	% +	No. exd.	% +	No. exd	% +
													1-9		10-19		20-29		30-39		40-49		Over 50		...	...
Soochow	Snell and Chang, Ch. Med. Jl., 21/36. a)	In-pt.	586	43.2	166	24.1	752	39.0	660	40.0	92	30.4	11	18.1	75	29.3	252	47.7	199	42.7	140	47.8	75	29.3	...	...
Peking ...	Korns, Ch. Med. Jl., 20/624.	Domest. Serv.	301	12.6	60	3.3	361	11.0	278	11.1	83	10.8	...	...	...	...	...	...	...	...	...	...	...	...	...	...
													1-10		11-20		21-30		31-40		41-50		51-60		Over 60	
Peking ...	Sia, Ch. Med. Jl., 21/39. b)	Med. In-pt.	494	24.1	8	12.5	502	25.9	327	26.3	175	19.4	11	0.0	58	5.2	174	16.1	137	38.7	71	36.6	39	20.5	12	16.7
Peking ...	Tsen. Ch. Med. Jl., 20/159.	Pat. and Serv.	1318	16.1	318	9.43	1636	14.79	1011	15.4	423	c) 12.8	18	0.0	151	3.3	450	13.4	310	23.5	146	23.3	63	17.4	29	d) 6.9
Peking ..	Korns, Ch. Med. Jl., 21/382.	Domest. Serv.	608	12.0	105	5.7	713	11.0	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Peking ...	Tso, Ch. Med. Jl., 23/226.	Hosp. Employ.	..	...	...		953	8.0	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

Remarks: (*a*) The one-two-and three-plus reactions were all regarded here as positive, whereas Tsen considers only fourplus reactions as positive.
(*b*) Foreign patients are included in these statistics.
(*c*) Sex unknown in 202 cases with 32 positives (16%)
(*d*) Age ,, ,, 469 ,, ,, 57 ,, (12%)
(*e*) Tsang (Nat. Med. Jl. 1925, p. 173) writes:
"Out of 1797 Wassermann reactions done at the St. Luke's Hospital, Shanghai in 1923 (75% being done as a routine for the inpatients of the Hospital), 438 gave positive reactions, *i.e.* 30%".

Table Vb. Evidence of Wassermann Positives in certain countries.

Country.	No. exd.	% +	Categories exd.		
China	4917	17.3	Patients & healthy persons (see table Va)		
France	1040	38.5	With chronic dis.	608	(48.6% +)
			Insane	329	(26.7% +)×
			Maternity c.	103	(15.5% +)
×Great Britain	4613	18.2	Gen. Hosp. pt.	1483	(20% +)
			,, ,, ,,	1435	(10.2% +)×
			Insane	552	(22.8% +)×
			Maternity c.	271	(24.7% +)
			Nervous dis.	122	(41.0% +)
			Eye dis.	250	(50.0% +)
			Healthy pers.	500	(9.4% +)
×U.S.A.	18458	20.1	Gen. Hosp. pt.	10935	(26.4% +)
			,, ,, ,,	484	(12.0% +)×
			Insane	3000	(15.0% +)
			Maternity c.	1839	(2.5% +)
			Med. & neur. c.	1700	(12.0% +)
			Med. c.	500	(12.8% +)

Remarks :

The figures for France and Great Britain are culled from Vedder, Syphilis and Public Health, 1918; those for U.S.A. from Tse, China Medical Journal, 1923, p. 228.

* Means cases with manifest syphilis or metasyphilis deducted.

TABLE VI.
(Incidence of V. D. according to occupation).

	Soochow		Canton		Peking (a)		Peking (b)		Peking (c)		Shanghai		Total.	
	Snell and Chang Ch. M. Jl., 1921, p. 36		Oldt, Ch. M. Jl., 1923 p. 776		Tso, Ch. M. Jl. 1923 p. 226		Tsen Nat. M. Jl. 1920 p. 159		Sia, Ch. M. Jl., 1921 p. 39		Tsang, Nat. M. Jl., 1925 p. 172		(Exclusive of Tsang's figures)	
	Routine Wasser. Test, In-pts.		Clin. diag. V. D. In-pts		Wasser. React. in Hosp. employees		Wasser. React. in pts. & serv.		Wasser. React. In-pts.		Clin. diag. primary syphilis in outpats.			
	No. exd.	% +	No. exd.	% +	No. exd.	% +	No. exd.	% +	No. exd.	% +	No. exd.	% +	No. exd.	% +
Soldier, Officers	58	40.0	235	44.7	—	—	199	25.12	117	23.3	—	—	609	35.8
Police	19	47.4	—	—	—	—	—	—	—	—	—	—	19	47.4
Farmer	208	34.1	244	4.4	—	—	66	7.57	31	16.1	—	—	549	16.8
Laborers	98	40.8	243	23.0	746 Mechan. Cooks. coolies helpers	9.2	698	14.18	101	20.1	55	52.0	1886	15.3

Business	69	52.1	183	38.0	—	—	174	18.96	63	33.3	26	24.5	516	31.8
Student	46	37.0	117	11.4	clerks, nurses, dressers technician		Learned class		76	2.6	Learned class		239	13.0
Profes-sional	37	35.0	—	—	192	3.1	212	5.66	55	7.0	8	7.5	476	7.1
House wife	68	26.4	—	—	—	—	—	—	—	—	—	—	68	26.4
Miscell-aneous	38	30.0	—	—	—	—	6	50.0	41	31.7	—	—	85	31.8
No special work	86	47.6	Children 122	0	—	—	—	—	38	28.9	—	—	246	21.1
Not Recorded	—	—	—	—	15	6.6	281	14.23	—	—	17	16.0	296	13.8
Total	754	39.0	1144	21.3	953	8.0	1636	14.79	502	23.9	106	10.0	4989	19.5

TABLE VII. PROSTITUTION IN CERTAIN CITIES IN CHINA.

Locality.	Reference.	Year.	No. prost.	Per capita. of Pop.
Canton	Oldt, Ch. Med. Jl., 1923, p. 776.	1921	1936	1 :837
Shanghai (Intern. Settl.)	Rep. of Vice Comm., Nat. Med. Jl., 1920, p. 126.	1871	1612	?
		1919-20	4522	1 :147
Harbin		1911	300	1 :80
		1921	3412	1 :41
		1926	1459	1 :82
Taheiho		1926	116	1 :138
Newchwang		1926	967	1 :113

WU LIEN TEH.

BERIBERI CONTROL FROM AN ADMINISTRATIVE STANDPOINT.

PAPER READ AT THE TOKIO CONFERENCE 1925 OF THE FAR EAST. ASS. OF TROP. MED.

It is generally agreed that beriberi is caused by the lack of a certain vitamin (B) in the diet of the patients attacked.

While our mind automatically turns to the connection of overmilled or deteriorated rice with this disease, we must not forget that this staple food in many countries is not the only one that can cause it. Indeed, numerous observations have proved that beriberi does occur in persons subsisting on diets quite different from those of rice eaters, thus lending strong support to the validity of the deficiency theory.

Apart from this deficiency theory, many authors held and still hold other views in regard to the cause of beriberi. Some maintained that the absence or insufficiency of the antineuritic vitamin, i.e., a *negative* factor is unable to account for the positive symptoms of the disease. Suzuki of Dairen, for instance, who studied beriberi for eight years by rat-feeding experiments and in infants who are more suitable subjects than adults since they require more vitamin, maintains that although avitaminosis plays an important part in the causation of beriberi, it is by no means the sole cause. These writers believe that infective agents (vegetable or protozoal in nature) play a role in the causation of the disease or are directly responsible for it; the agents may pre-exist in the intestines before a faulty diet favours their influence, or they may be ingested together with certain foodstuffs, notably rice, or conveyed from man to man by parasites.

Others believe in a toxic origin of beriberi, in that toxic substances are formed either in the foodstuffs before ingestion or in the intestines themselves.

A third category believes in the combined role of the infective and toxic agents, living organisms being responsible for the formation of the toxins.

It may be summarised, however, that an unbiassed scrutiny of the evidence fails to show any influence of infective or toxic agents apart from a faulty diet. It is probable that toxic influences play an important role in the pathogenesis of the disease, but if so, they are the result of a faulty metabolism due to a lack of antineuritic vitamin.

It remains to be seen how far living organisms might take part in this process. There is no doubt that detailed evidence has to be worked out in order to fill the gaps, but when the facts are clearly demonstrated, they will not be prejudicial to the accepted theory of avitaminosis.

While upholding the deficiency theory, we must not assume that all who partake of a diet poor in vitamins invariably develop beriberi, or reversely that all who have at their disposal foodstuffs not artificially robbed of the vitamins invariably escape. On the contrary many observations show that the original value of the foodstuffs is not of such decisive importance as the actual state in which they are ingested, and that, moreover, much depends on the physical and mental condition of the individual.

Inasmuch as this chain of different factors is of great theoretical interest, and some of the factors have an important bearing on the practical measures for beriberi prevention, it is necessary to discuss them in detail, laying special stress on the conditions where rice forms the stable food.

a. *Deterioration of rice during storage.*

It has been proved by many observers(1) that foodstuffs which originally contain a sufficient amount of vitamin may lose their value in this respect by being *stored* too long or under unsuitable conditions. This specially holds true for rice, as Ottows remarks "compared with polished rice, unpolished rice becomes easily and rapidly unfit for consumption." It has been suggested that the rice deteriorates not because the long or improper storage has rendered it infectious or poisonous, but that moulds or weevils may be instrumental or helpful in bringing about the destruction of the vitamin-holding layers of the grains. In is certain that climatic influence, especially moisture, plays on important role in this deterioration, and this factor may partly explain the marked seasonal incidence of beriberi.

b. *Loss of vitamin through improper preparation of the rice.*

Certain methods of *preparing* the food may rob it of its anti-beriberi properties. Though the anti-neuritic vitamin is rather thermostabile, for Chick and Hume(2) showed that wheat embryo can stand a temperature of about 100°C. for two hours without significant loss in anti-neuritic vitamin and that only at a temperature of 120°C. a swift destruction of the anti-neuritic properties occurs, yet overcooking occurs in practice. For several authors ascribe the origin of beriberi outbreaks to the cook-

(1) Harriss (1909). qu. Trop. Dis. Bull, vol. 5. p. 461; Gouzien, Ann. d'Hyg. and Med. Colon., 1912, vol. 15, pp. 445-491; Schueffner and Kuenen, Arch, f. Schiffs und Tropenhyg., 1912 Beiheft 7; Gimlette, Ann. Rep. Malay States. 1912; Jennissen, Geneesk, Tijdschr. v. Ned-Indie, 1913, vol. 53, pp. 570-583; Editorial, Trop. Dis. Bull., vol. 4, pp. 211-214; Ottow, Geneesk. Tijdschr. v. Ned. Indie. 1915, vol. 55, pp. 75-131; Editorial, Trop Dis. Bull vol. 5, pp. 461-462; Ann. Rep. Med. Lab. at Weltevreden, 1920; Blacklock. Sierra Leone Ann. Med. and San. Rep., 1922, App. 5; Megaw, Indian Med. Gaz. 1923, vol. 58, pp. 193-203; Megaw and Bhattacharjee, ibid, 1924. vol 59, pp. 169-173.

(2) Proc. Roy. Soc., 1917, Ser. B., vol. 90, pp. 60-68.

ing of food at a too high temperature or to too prolonged boiling(3). It is proved also that too much washing or too long soaking of the rice may be harmful. Schueffner and Kuenen summarise this problem with the statement "The final value of the rice depends not only on the amount of polishing, but on methods of washing, cooking, and storage. Purchasing the same kind of rice does not, therefore, mean eating the same kind."

c. *The correct correlation between the whole diet and the vitamin content.*

There is ample evidence to show that not so much the absolute amount of anti-neuritic vitamin ingested is of decisive importance for the onset of beriberi, but rather the proportion of this vitamin to the whole diet. Maurer(4) and other observers(5) have noted that in birds the onset of polyneuritis can be hastened by an increase in the ration of polished rice.

Braddon and Cooper(6), after carefully planned experiments and observations on human beriberi cases, have definitely stated "that the amount of anti-neuritic substance required by the organism increases with the carbohydrate ingested." They assume "the active substance participates in some way in carbohydrate metabolism, and thus the more metabolic work the organism is called upon to undertake the greater its demand in respect of this essential substance."

This conception is endorsed by many authors(7), while a few contradict it(8).

d. *Individual factors favourable for the onset of beriberi.*

This problem is very complicated, because apparently different and even diametrically opposite factors can lead to the same result.

(3) Grijns, qu. by Eijkman. Transact Internat. Congress of Med , London 1913, Sec. XXI, part I, pp. 25-40; Braddon, Beriberi, London, 1907; Schueffner and Kuenen, l.c.; Fraser 12th Ann. Rep., Inst. Med. Res. Kuala. Lumpur, Malay States, 1912; Chamberlain Am. Jl. Trop. Dis. and Prev. Med.. 1913, vol. 1, pp. 121-128; Idem, Jl. Amer. Med. Ass., 1915, vol. 64, pp. 1215,-1220; Ottow, l.c.; Trop. Dis. Bull., vol. 6, p. 147, and vol. 8, p. 463; Weill and Mouriquand, C. R. Soc. Biol., 1916. vol. 79, pp. 194-199; Blacklock, l.c.; Stanton, 5th Congr. Far East. Ass Trop. Med., 1923.

(4) Muenchner Med. W., 1907, vol. 54, pp. 371.

(5) Cooper, Journal Hyg., 1913, vol. 12, p. 436; Caspari and Moszkovski. Berl. Klin. Woch., 1913, vol. 55. p. 1515; Funk, Z. f. Phys. Chemie, 1914, vol. 89, pp. 378-380.

(6) B. M. Jl., 1914, I, pp. 1348-1349 and Jl. Hyg., 1914, vol. 14, pp. 331-353.

(7) Ashburn. Proc. Med. Ass. Isthmian Canal Zone, 1916, vol. 7, pp 101-129; Abdou, Jl. Am. Med. Ass., 1918, vol 71, pp. 1298-1299; Simpson B. M Jl.. 1920, I, pp. 735-736; Mouriquand, etc., C. R. Soc. Biol.. 1922. vol. 87, pp. 168-169; Chomori, etc., Japan Med. World, 1922, vol. 2, pp. 128-133, 1923, vol. 3, pp. 231-238 and pp. 249-250; Randoin and Simonnet. C. R Acad. Sc., 1923, vol. 177, pp. 903-906; Mc. Carrison, B. M. Jl., 1924, I. pp. 414-420.

(8) Vedder, Jl. Amer. Med. Ass., 1916, vol. 67, pp. 1494-1497; idem, Jl. Hyg., 1918, vol. 17, pp. 1-9

For instance, many authors emphasized "that in epidemics of beriberi the well nourished are the first to succumb, and are actually more liable to the disease than the underfed. Similarly, under natural conditions, men, owing to their larger energy output, partake of polished rice more freely than women and are more liable to beriberi. In institutions, however, where men and women have the same fixed ration, they are equally susceptible to the disease" (Braddon and Cooper).

It was observed also that on board ship the stokers who have particularly heavy work developed the disease exclusively or suffered more heavily as compared with the rest of the crew[9]. On the other hand, the lack of exercise was blamed as an important factor[10]. Certain predisposing causes are exhaustion through climate conditions[11], debility and starvation[12], alcoholism[13] opium habit, irregular life[14] and certain diseases such as malaria[15], influenza[16], status lymphaticus[17], exhaustion after operation[18], amoebic and bacillary dysentery[19] and other gastro--intestinal disorders[20].

Some of these diseases may be indirectly caused by climatic conditions[21]. In individuals with impaired digestion, a diet which might be safe for a normal person might lead to beriberi[22].

Possibly the lack of exercise, a too monotonous diet[23], and mental strain[24] act in the same way.

---

(9) Browning, B. M Jl., 1912, II, p. 69; Egan. Jl. Roy. Nav. Med. Serv., 1917, vol. 3, pp. 195-201.

(10) Shiga. Arch. f. Schiffs and Tropenhyg. 1912. vol. 16, pp. 522-526; Gouzien. l.c.; Simpson. Lancet. 1919, ii, pp. 1027-1028; Blacklock, B.M. Jl., 1924. I. pp. 1046-1047, Boycott, ibidem, p. 1112.

(11) Gouzien. l.c., Genuardi, Ann. di. Med. Nav. and Colon.. 1913, vol. 19, pp 12-22; Kennedy, Jl. R. Army Med. C.. 1915, vol. 25. pp. 268-285; Basset-Smith, Jl, Roy. Nav. Med. Serv., 1924. vol. 10, pp. 34-38

(12) Shiga, l.c.; Jennissen, Geneesk. Tijdschr. v. Ned-Indie, 1913, vol. 53, pp. 570-583; Richer, Ann. d'Hyg. and Med. Colon. 1913, vol. 16, pp. 145-156; Hehir, Ind. Jl. Med. Res.. 1919, Congress No., pp. 44-59; Ashford. Amer. Jl. Trop. Med., 1922, vol. 2, pp. 305-340.

(13) Clair, Bull. Soc. Path. Exq. 1920, vol. 13, pp. 101-106.

(14) Cobb, App. to Territorial Rep. for 1916, North Borneo.

(15) Hehir, l.c.; Clair, l.c.; De Milita, Gac. Med. de Caracas. 1921, vol. 28, pp. 220-228; Boinet, C. R. Congres de la Sante Publique. etc . Marseilles, 1922, pp. 110-113.

(16) Marchoux, Bull. Soc. Path Exq., 1920, vol. 13. pp. 196-199; Suldey, ibid.. 1922, vol. 15, pp. 476-484.

(17) Chomori, etc., l.c. (1923).

(18) De Milita, l.c.: Schneider, Z.f. Chirurgie, 1922, vol. 49, pp. 1357-1361.

(19) Strong, Jl. Trop. Med. and Hyg. 1914, vol 17, pp 310-311; Maxwell. qu. Trop. Dis Bull., 1915, vol. 6, p. 146; Reed Boston Med. and Surg. Jl. 1916, vol. 175, pp. 375-380; Suldey, l.c.

(20) Willcox, Lancet, 1916, I, pp. 553-557; Clair. l.c.; De Milita. l.c.

(21) Kennedy, l.c.

(22) Strong, l.c.

(23) Strong and Crowell, Ph. Jl. Sc., 1912, Sec. B., pp. 271-411; Basset-Smith, Jl. Roy. Nav. Med, Serv., 1924, vol. 10, pp. 34-38.

(24) Shiga, l.c.; Kennedy, l.c., Sprawson, Qu. Jl. Med , 1920, vol. 13, pp 337-355.

As beriberi often leads to gastro-intestinal disturbance[25], a vicious circle is in some cases established.

Another important factor is the strain of pregnancy[26]. This is especially disastrous, as the disease is given by nursing mothers to their babies.

Not rarely, the poor who cannot afford to buy "fine" (overmilled) rice suffer less; this was stated for the Philippines for instance[27]. In other countries, this state of affairs does not prevail[28]. While the coolie class is most affected, the well-to-do are not exempt. Lovelace[29] mentioned that beriberi attacked the better classes as well as the coolie labourer......, one of the cooks, two of the nurses, and two of the hospital physicians were involved.

In my own record of the occupation of 28 beriberi patients in the Shantung Road Hospital in Shanghai, there were 15 soldiers, 3 shopmen, 1 cook, 1 detective, 1 tailor, 1 clothier, 1 actor and 1 penmaker.

Overcrowding and unhygienic surroundings may also be predisposing factors[30], leading, as they do, to improper preparation of the rice, debility from the lack of sleeping accommodation, lack of exercise, etc.

Before we discuss the measures for the prevention of beriberi, it may be well to enumerate the resolutions passed at the previous meetings of the Far Eastern Association of Tropical Medicine :—

i. 1910: "Resolved.—That in the opinion of this Association sufficient evidence has now been produced in support of the view that Beriberi is associated with the continuous consumption of white (polished) rice, as the staple diet, and the Association accordingly desires to bring this matter to the notice of the various Governments concerned."

ii. 1912: "Resolved.—That the accuracy of the opinion of this Association has received further and more complete confirmation by investigators in Japan, China, French Indo-China, the Philippine Islands, Siam, Netherlands-India, the Straits Settlements and the Federated Malay States, namely that 'Beriberi is associated with the continuous consumption of white (polished) rice as the staple article of diet.'

---

(25) Shiga, l.c.; Mc. Carrison Indian Jl. Med. Res., 1920, Congress No., pp. 38-43.
(26) Shiga, Zentralbl f. Bakt., 1912, Ref., vol. 54, Beilage, pp. 156-170
(27) Laws, Jl. Am. Med. Ass., 1912, vol. 59, p. 463.
(28) Cobb., l.c.
(29) Lovelace, Jl. Am. Med. Ass., 1912, vol. 59, pp. 2134-2137.
(30) Gouzien, l.c.; Roger Medicine, 1919, vol. 1, pp. 151-152; Simpson, Lancet, 1919, 1, pp. 1027-1028; Clair, l.c.; De Milita, l.c.; Boyd. Jl. Army Med. C., 1922, vol. 38, pp. 303-306; King B. M. Jl., 1924, 1, pp. 688-689.

It is therefore again desired to bring this opinion to the notice of the various Governments concerned and to recommend international action."

iii. 1913: Resolved.—

I. That in the opinion of this association it has been proved that Beriberi is caused by a deficiency in diet of certain substances of which the exact nature is not yet full known.

II. That such substances are present in sufficient quantity in unpolished (undermilled) rice.

III. That therefore it is advised that the governments of those countries where rice forms the staple article of diet should encourage by all possible means the use of unpolished (undermilled) rice.

iv. 1921 Resolved.—Whereas beriberi is known to prevail extensively in the following countries:

Netherland East Indies, Japan, Malaya, Siam, Borneo, Philippines, Indo-China, Hongkong, China, and other territories in the Far East; Whereas there is enormous annual loss of human life, with corresponding invalidism and disability, due to deficient diet in the above countries, and whereas the deficiency is mainly due to the overmilling of rice which removes a vital part of the essential food factors and whereas nothing has been put forward in the past ten years which disproves that beriberi cannot be controlled by substituting undermilled for polished rice in countries in which rice is the staple article of diet.

Whereas it has been demonstrated by Fraser and Stanton and others that a satisfactory standard of milling is the presence of a minimum of 4/10 of 1% of P^2O^5 (phosphorus pentoxyde) in rice; Therefore be it resolved that this fourth Congress of the F.E.A.T.M. considers it urgently desirable that the Governments concerned should take action to discourage the use of rice which is below this standard, therefore be it further resolved that, with a view to taking united action, the F.E.A.T.M. recommends the appointment of a commission to which each country is asked to send a delegate, which shall make recommendations as to the best methods of bringing beriberi under control......"

v. 1923: "......The Association is of opinion that, consequent upon the divergence of views disclosed in the statements of the official delegates any international convention is at

The Association reaffirms its opinion that beriberi is a disorder of nutrition and that in the Far East the principal factor in its causation is a diet of which over-milled rice forms the staple.

The Association recommends that interested Governments be invited to promote further research in the following questions in relation to beriberi control :—

(a) the standardization of rice;

(b) the effects of transport and storage on rice:

(c) economic considerations.

The Association recommends that each of the Governments interested and the International Health Board of the Rockefeller Foundation be invited to nominate a representative on a "Beriberi Committee" which shall report at the next Congress...... The Association considers that, in the meantime, individual Governments should take such action for the control of beriberi as may be suited to local conditions in their respective countries, and should devote special attention to devising and applying practical methods of improving the diet of the general population with regard to the too exclusive use of over-milled rice, and should be requested to make available to the next Congress of the Far Eastern Association of Tropical Medicine systematic observations and statistical data showing the result of these methods.

The Association considers that educational methods of control on the basis of the available scientific knowledge should be vigorously applied in all countries."

It can be seen that the definite tone of the resolutions of former years have given way to the less definite recommendations of recent years. It can also be seen that the idea of taking steps against beriberi by international agreement has been considered impractical. We must realize that white or overmilled rice is in demand both by the poor who are liable to beriberi and by the rich who are not so liable by reason of their diversified diet.

White rice is in demand also in countries where beriberi is unknown. Moreover, the rice exporting countries are not always those which are affected by the disease and consequently "will not take great interest in preventing the disease in other countries."(31).

The measures that may be taken against beriberi are legislative and educational, and in order to get the best results, they will have to be combined.

1. *Legislative measures.*

Legislative measures will be most effective in providing undermilled rice for public institutions, such as prisons, asylums, hospitals, and railway construction camps, etc. The resulting freedom from beriberi will form a splendid object lesson to show how beriberi can be prevented, and to keep up the demand for undermilled rice.

Stanton's proposal to have Government subsidized mills[32] where proper rice may be obtained deserves mention. He also states[33] that in the Federated Malay States a government rice mill is established which provides for public institutions. By these means the proper kind of rice is gradually introduced, and when the people are awakened to the real cause of beriberi by educational propaganda, as it has been done in the Dutch Indies [34] and Malay States[33], they will find there is a supply of undermilled rice to meet the demand. This would meet Heiser's objection[35] that after a campaign of education has been most persistently carried out in the Philippine Islands during the past four years, principally through teaching some 400,000 pupils in the public schools; unfortunately even after the public was prepared to use the unpolished rice it has been impossible to obtain it, because the rice mills managers did not care to change their process of manufacture.

To prohibit the production or the import of overmilled rice by legislation is very difficult and will be opposed by all classes of people. To complete the scheme, methods of polishing the rice both in the inland and on the coast will have to be controlled. Further than that, the proper storage of the rice, and the proper quantity in vitamin value at the time of sale to the consumers will have to be assured. Finally there is still the proper washing and cooking of the rice to be insisted upon.

It has been proposed to tax the white or overmilled rice, so that the price is enhanced and the poor who are liable to beriberi would not be able to afford it. This measure has many objections. In many countries white rice is considered the proper rice and it is considered "correct" to partake of it. Instead of foregoing this rice, people may even economize on other foodstuffs in order to buy it. Anyhow for political and other reasons "no government as yet has been willing to make the experiment." (Vedder[36]).

---

(31) Heiser, Memorandum to the International Health Commission, New York, October 26, 1915.

(32) Transact. 5th. Congress F.E.A.T.M., 1923.

(33) Quoted Tr. Dis. Bull., 1924, Suppl. 2; p. 110.

(34) Geneesk. Tijdschr. v. Ned-Indie, 1920, vol. 60, pp. 779-788.

(35) Heiser, Paper read at the 8th. Ann. Meeting of the Phil. Islands Med. Ass., Febr. 23, 1911; Potter, qu. by Jansen, l.c., p. 264.

(36) The Practice of Med. in the Tropics, ed. by Byam and Archibald, vol. III, p. 2026.

2. *Educational measures.*

Having accepted the workable theory of "no overmilled rice, no beriberi", it behoves us to inform the people of the absolute necessity of eating rice that is not robbed of its vitamin containing pericarp. The proper storage and the proper method of washing and cooking the rice, even of the right kind, must be taught.

The importance of the substitutive foodstuffs must be emphasized. Fresh vegetables, cabbage, bean sprouts, fresh fruits and potatoes are some of the necessary adjuvants, containing as they do much vitamin.

Thus, Scheuffner and Kuenen[37] ascribed the present immunity of the Japanese who eat the same rice as the Chinese to the fact that they take more fruit and vegetables, Heiser[35] also states the disease is not rampant among the inhabitants of the Batanes Islands who eat imported polished rice because "meat and potatoes are more commonly used than in other parts of the Philippines."

The ideal to be aimed at will be the consumption by the people of an undermilled rice which is properly stored, and properly cooked, with the addition of a sufficient amount of vitamin containing foodstuffs so as to ensure the correct correlation between the whole diet and the vitamin content.

In pointing out the cause, the public must at the same time be taught the signs of the disease and the advantages of and favourable prognosis in early treatment.

Extensive and persistent propaganda ought to be carried out by the government, by the medical profession, by public health and other institutions in the form of pamphlets, circulars, exhibits, cinema films, talks in the newspapers and lectures in schools. All classes of people, both the employers and the employes, should be reached in clear and no uncertain language, to the end that by making the people realize the necessity of eating undermilled rice, a demand for it will be created.

The government must not stop at propaganda alone. It can demonstrate indeed the superiority of the overmilled rice as a beriberi preventive by showing the good results of its use in prisons, army and navy and other public institutions.

More than that, it must see to it that there is a supply of cheap undermilled rice when the time for a demand comes. This it can do by subsidizing rice mills or by starting its own mills.

By a judicious combination of both educational and legislative measures, the day may come when beriberi will be a rare disease, and the mortality and morbidity from it will be materially lessened in a large part of the Orient where rice still forms the staple food of the people.

---

(37) L. c.

SUMMARY.

1. In order to control beriberi it is necessary to combine legislative and educational measures. In fact, the two tend to overlap.

2. Legislative measures consist of the provision of undermilled rice for public institutions, the subsidizing or the establishment of rice mills which will produce the proper rice.

   The taxation on white rice will impose much hardship on the people and countries like China, Japan, Siam and India are not likely to adopt this measure.

3. The public must be educated by effective propaganda and made to realize the advantage of undermilled rice.

   The association of white rice with beriberi should be made known widely.

4. The importance of vitamin containing foodstuffs, such as fresh vegetables, cabbage, bean sprouts and fresh fruits should be emphasized. There is no doubt that with the ingestion of these foodstuffs in sufficient quantities, beriberi may be avoided even though white rice be consumed.

5. The public must be taught that hygienic living has much influence in the abolishing of beriberi, in addition to proper dieting, and that early cases of the disease are much more amenable to treatment than late cases.

J. W. H. CHUN, M.B.

WU LIEN TEH, M.D., SC.D., ETC.

PUBLIC HEALTH ASPECTS OF THE NARCOTIC PROBLEM.

(Being a paper read before the Sixth Conference of the Far Eastern Association of Tropical Medicine, Oct. 1925.)

No one who has looked into the narcotic problem as it exists in Far Eastern Countries can help being struck by its magnitude and proportion. India, Burma, Ceylon, Siam, French Indo-China, Dutch Indies, British Malaya, Hongkong, Macao, China, British North Borneo and Sarawak are more or less affected by it. Until the American occupation of the Philippines the opium problem also presented an acute phase there, but fortunately thanks to a beneficent policy on the part of the Government the evil has disappeared since 1908. In the Japanese colony of Formosa, thanks to a consistent policy followed for the last 20 years, we are also on the verge of seeing the end of the traffic within the next decade, only 38,000 smokers still existing out of a population of 3,700,-000.

That the conscience of the world has been awakened is shown by the succession of Opium Conferences held at Shanghai (1909), the Hague (1911-12, 1913, 1914) and Geneva (1924, 1925). The Hague Convention of 1912 was drafted by leading medical experts as well as statesmen and contained valuable data regarding the scientific aspects of the narcotic question. Unfortunately, largely owing to the financial sacrifices involved many states preferred to adopt a *laissez faire* policy, and the last 15 years have witnessed a recrudescence instead of a progressive diminution of the trade in narcotics. The last International Opium Conference held at Geneva was particularly disappointing because of the withdrawal of two leading participants, namely America and China. It may be remembered that when extending an invitation on October 18th, 1923, to the Powers signatory to the Hague Opium Convention, the League of Nations clearly defined two purposes :

1.—If the purpose of the Hague Opium Convention is to be achieved according to its spirit and true intent it must be recognised that the use of opium products for other than medical and scientific purposes is an abuse and not legitimate.

2.—In order to prevent abuse of these products it is necessary to exercise the control of production of raw opium in such a manner that there will be no surplus available for non-medical and non-scientific purposes.

The American Delegates complained that in spite of two months of discussion and repeated adjournments, the purposes for which the Conference was called had been vitiated by the agreement it was pro-

posed to sign. In other words, the insistence of the British Delegation (through her Chief Delegate, Lord Robert Cecil), that opium smoking would not be abolished in British Far Eastern territories until 15 years after China had effectively stopped growing and smuggling opium into those territories, led to a crisis and to the withdrawal of the American and Chinese Delegations. No wonder the Eastern peoples asked if the Western nations are serious over their often expressed desire to exterminate the opium evil whenever financial interests are threatened. Those of us who have watched the excessive smuggling of opium and morphine into China during the years 1908-12, when China was rid of every poppy field, by unscrupulous but superficially respectable personages, regret particularly this attitude.

Turning now to the more immediate objects of my paper, I venture to suggest that from a public health point of view the ravages of narcotics, if uncontrolled, are such as to demand the closest attention from the medical profession. For too long already the discussion of narcotics from a world standpoint has been left to lay enthusiasts, wily politicians and hard hearted revenue collectors. On one hand the extent and harm wrought by opium and deleterious drugs have been somewhat exaggerated, while on the other, financial considerations have almost blinded the eyes of responsible officials to the evils in their midst.

To make my point clear, I have constructed certain tables showing :

(*a*) The quantity of opium consumed by various countries in the Far East.

(*b*) The quantity of opium consumed per capita of population.

(*c*) Proportion of addicts to the population in certain places.

(*d*) Percentage of revenue derived from opium.

TABLE SHOWING COMPARATIVE FIGURES OF OPIUM USING COUNTRIES.

A. OPIUM EATING COUNTRIES.

Country.	Total Popul.	No. addicts	°/o addicts	Quantity Opium used (in lbs.)	Per head Population (in ozs.)	Authority.
India	247.003.293 (1922)	see sep. list		674,421 (1921-22)	0.04	Leag. of Nat., Doc., O. P. 23(y)

B. OPIUM SMOKING COUNTRIES.

Country.	Total Popul.	No. addicts	°/o addicts	Quantity Opium used (in lbs.)	Per head Population (in ozs.)	Authority.
China	425,000,000	2,250,000 (approx.)	0.53	15.680,000 (app) (1923)	0.59	Wu Lien Teh
Philippines	10.314,310 (1918)	24,000 (1903) (none now)				Bishop Brent (Comm. of the Houses of Rep., May 29, 1923.)
Brit. Malaya	1922: 3,437,841 1,174,777 (Chinese)			246,809.5 (1923)	1.15 (t. pop.) 3.36 (Ch. ,,)	Leag. of Nat., Doc., C. O. P. 5
Hongkong	1921: 662,200		20-25 adu. m. 1-2 adu. fem. (1924)	31,989 (1923)	0.77	Proc. Br. Malaya. Opium Comm. 1924.
Br. North Borneo	257,804 (40,000 Ch.)			9,273.3 (1923)	0.58 (t. pop.) 3.7 (Ch. ,,)	Leag. of Nat., Doc., C. O. P. 5
Sarawak	600,000 (30,000 adu. m. Chinese)	5,000 (Chin. only)	17 of adu. m. Chinese	14,212.3 (1923)	0.38 (t. pop.) 7.58 (adu. m. Ch.)	—ditto—
Siam	9,121,000 (1920-21)	200,000 (mostly Siamese)	2.2	154,338 (1920-21)	0.27	Leag. of Nat., Doc., C. O. P. 1
Macao	74,866 (71,022 Ch. (1910)			23,401.5 (1924)	5.27 (Ch. pop.)	—ditto—
French Indo-China	20,000,000	7,000	0.3	163.520 (1923)	0.13	Clinchant, speech at 1st. Op. Conf. 1924
Dutch East-Indies	1920: 49,350,834 (400.000 Ch.)			182 894 (1921)	1920: 1.47 (Ch. Pop.) 0.024 (Nat. Pop.)	Leag. of Nat., Doc., C. O. P. 13
Formosa	3.807.329 (1921)	38.000 (1924)	1	107.100 (1923)	0.45	Kaku (Willoughby's Op. as an Intern. Prob. p. 121.

C. OPIUM SMOKING AND EATING COUNTRIES.

Country.	Total Popul.	No. addicts	°/o addicts	Quantity Opium used (in lbs.)	Per head Population (in ozs.)	Authority.
Lower Burma	13,000,000 (149,060 Ch.) (1921)	1921: 5405 (Nat. pop.) 17229 Ch. ,,	0.04 (Nat.) 11.55 (Ch.)	Rangoon 7,385.04	Rangoon 0.35	Leag. of Nat., Doc., C. O. 23 (Y) and Andrews, Manch. Guardian, June 5, 1925
Ceylon	4.504,549 (1921)	Eaters: 10,645 (1921)	Eaters: 0.23	1921: 5.369 E. 1923: 564 E.	0.02	Leag. of Nat., C. O. P. 1

REVENUE FROM OPIUM (Asiatic Territories).

Government		Revenue from Opium-1922		Percent of total revenue
India	from exports	$9,775,000		
,,	internal	8.735.000		
			$18,510.000	2.8
British Malaya :				
Straits Settlements		$14,730,724		42.9
Federated Malay States		8,730,168		16.8
Johore		3,451,541		40.0
Kedah		1,691.850		33.3
Perlis		155,543		39.2
Kelantan		309,697		23.6
Trenganu		252.550		37.4
Brunei		40.001	$29,362,074	18.6 28.6
Hongkong			$2,921,065	22.4
Dutch East Indies			44,000,000 flor.	11.53
French Indo-China			14,900,000 piast.	27.3
Siam			16,764,758 ticals	43.22
Formosa			4,418,000	8.0
Macao			2,000.000	40.03

Some detailed statements may be added to the above.

(1) In India opium is taken by the mouth. Whereas the index figure of the League of Nations for internal consumption of opium is 12 lbs. for 10,000 population, in India this figure comes to 24. In certain districts, however, this quantity is exceeded by a wide margin. Thus

Bombay has	88	lbs.	(0.14 oz. per head)
Burma	56	,,	(0.089 ,, ,, ,,)
Assam	104	,,	(0.166 ,, ,, ,,)
Calcutta	288	,,	(0.460 ,, ,, ,,)
Rangoon	216	,,	(0.345 ,, ,, ,,)
Mergui	286	,,	(0.457 ,, ,, ,,)
Lahore	100	,,	(0.160 ,, ,, ,,)
Amritsar	56	,,	(0.089 ,, ,, ,,)
Madras	52	,,	(0.083 ,, ,, ,,) etc.

Opium is both made and sold as a Government monopoly, and women employed in cotton factories are in the habit of ad-

ministering the drug to children to keep them quiet. The wife of the present Governor of Bombay states that 98% of the mothers regularly give their babies the dope before starting their day's work. Children often look like persons who have suddenly grown old. While the mortality of infants ordinarily is 400 per thousand, this has occasionally risen in Bombay to 666 per thousand.

(2) In China and territories where Chinese congregate, opium smoking is resorted to but this habit is so "just, subtle and mighty" (as described by de Quincey) that it often overtakes whole communities of Siamese, Ceylonese, Malays and even some white people.

(3) Poppy cultivation in China was rigidly suppressed between 1908 and 1912, in fact so thoroughly that the British Legation reported in 1908, "China has not hesitated to deal with a question which a European nation, with all the modern machinery of government and the power of enforcing its decisions, would probably have been unwilling to face". The disorders of the past 12 years have temporarily dispelled these early hopes but the present reign of the militarists will not last long, for assuredly the will of the people which has always been against opium will assert once more. As it is, the present generation of opium smokers consists mainly of military officers and their retinue, sedentary officials, invalids, certain types of shop-keepers and coolies (e.g. mining, chair, etc.) especially in the southern and western provinces. Educators, students and the bulk of the peasant and labour classes are altogether free from the habit.

(4) Interesting records from British Malaya[1] show that the majority of Chinese acquire the habit after they have landed on British soil. Thus :

Institution :	No. examined :	% acquiring habit in B.M. :
Immigration	1086	86.7
Hospital	1170	70.9
Decrepid wards .	136	61.0
Leper Hospital .	584	58.0
Ricksha pullers ..	?	65.0

(5) The quantity of opium used per head of total population varies from 0.02 in the case of Ceylon, 0.04 (India), 0.13 (French Indochina), 0.59 (China) to 5.27 (Macao). If we count only the Chinese element of the population in British Malaya, North Borneo, Sarawak, Dutch Indies, we find a percentage of 3.36,3.70,7.58, 1.47 respectively.

[1] Report of Opium Committee, 1924

(6) The revenue from opium in these territories ranges from 2.8% in the case of India, 28.6% (British Malaya), 22.4% (Hong-kong), 40% (Macao) to 42.9% in the case of Straits Settlements. These figures give us an idea as to the opposition that may be expected from revenue collectors, when any medical reform is entertained.

Certain reflections come to one's mind from a study of the above. How far are our early teachers in the medical schools right when they warn us against the promiscuous and thoughtless use of opium upon individuals? If the prescribing of opium is to be carefully guarded in hospitals and medical practice, how is it that governments can dole out opium indiscriminately to young and old in their Eastern territories? More than once have I heard responsible persons say that opium may be bad for the West but is good for the East! And also that Easterners need such a sedative (called stimulant, when it suits the occasion) in place of alcohol or worse. So far as I know, medical science has not yet demonstrated such distinction between the East and West. The oft-repeated misrepresentation that unless Chinese coolies obtained their opium there would be a shortage of labour in British Malaya and the East Indies is disproved by the fact that during the World War, 95,000 coolies were recruited from North China for service in France. "Not a man smoked opium," reported the British Medical Officers in charge, "they were contented and would volunteer again." Moreover the recent findings of the British Malaya Opium Committee, as stated earlier in this article, show that the majority of Chinese labourers only learned the pernicious habit after their arrival in the Colony. In my opinion the same degree of toleration witnessed among Chinese opium smokers may be effected also in any other race if the same facilities are provided. Neither must we forget the unnecessarily large number of suicides arising from easy access to opium in countries where it is easily procured. I have a few statistics to illustrate this:

Shanghai Shantung Road Hospital:

Year:	*Total no. attempted suicides:*	*No. due to Opium:*	*Tot. adm.*
1914	—	389	71740
1915	—	338	62151
1917	—	281	83712
1918	470	235	50496
1919	501	234	77523
1922	815	408 (approxim.)	105989
1924	1274	637 (,,)	117397

NOTE:—The increase of 1922-24 is significant, for during these years opium has been more accessible than ever, and crimes of a violent nature have also flourished.

Harbin Plague Prev. Hospital:

Year:	*Attempted suicides with opium*:	*Tot. adm.*
1922	13	7860
1923	40	16597
1924	40	15789
1925 (Jan.-August)	37	16049

Inquiries in other hospitals will probably reveal a similar state of affairs.

Surely the time has come when the medical profession, as standard bearers of humanity and public health, should speak with one voice upon this all absorbing problem. For, if allowed to continue, the traffic in narcotics will surely expand and claim victims even among nationalities other than Eastern peoples.

A few words may be devoted to the action of opium upon patients suffering from some important diseases. This is very necessary in view of the popular belief that the drug protects and even cures. In the case of *Cholera* we have Koch's early experiment(2) showing that, although ordinary guinea-pigs cannot be infected with cholera vibrios, yet by first injecting laudanum into the abdominal cavity, peristalsis is checked and cholera develops afterwards. Further, Rogers(3) states that opium eaters when suffering from cholera die of renal failure. Its harmful action in children constantly doped with opium can be imagined during such epidemics.

Similarly, in *Plague* there is no foundation whatever for the common belief in the efficacy of opium either as a prophylactic or remedy. On the contrary there is ample evidence that it tends to spread the disease. Thus:

(1) In 1921 an opium den kept by a Japanese woman in the Dalainor colliery was habitually visited by miners to protect themselves against the plague. It was only when three corpses were found one morning on the premises by our staff that we were able to throw off extraterritorial formality and seal up the house.

(2) In both the epidemics of 1910-11 and 1920-21 opium dens were found to be spreading centers. In fact our Russian colleagues in the Ussuri district of Siberia maintain that the initial case of the 1921 epidemic in their territory started from an opium house(4)

(3) In our series of plague *post-mortems* we often found morphine subjects among the dead.

---

(2) Deutsche Med. Wochenschr., 1885,

(3) The Practice of Medicine in the Tropics (Byam & Archibald). vol II, p. 1100.

(4) Vladivostok Plague Report, 1922, pp. 3 & foll

(4) Concerning the bubonic variety we have the testimony of the German Plague Commission [5] that "in spite of all statements made by the interested, opium eaters and opium smokers succumbed to the disease at least in the same ratio as healthy individuals." A similiar statement was recently made for Hongkong by Millot Severn[6].

With regard to *Malaria,* there seems to be a firm belief among lucky prospectors as well as the uneducated that opium is an effective prophylactic. The Chinese widely believe it and even a few old-fashioned western-trained men. However, Park of Soochow, who has had extensive practice among the people says[7] that the more he sees of opium smokers the less faith he entertains in its efficacy. Otto of Amoy voices a similar opinion[8], while Scheube actually considers opium smoking as predisposing to malarial infection. From my point of view it would be so easy to settle matters by watching scientifically the effects of opium and quinine side by side in a malaria ridden district. I venture to lay odds against opium.

When one turns to *Tuberculosis* one has to discuss the frequent and even mechanical use of opium and its derivatives for all forms of phthisis, leading often to an acquired habit. While acknowledging its beneficent effects in hemoptysis and uncontrollable cough, few of us will gainsay me when I state that in the majority of cases this powerful drug should be used with the greatest discretion. Among Chinese the number of patients with incipient tuberculosis who have acquired the habit is legion.

The same fallacious ideas prevail among Chinese in regard to other diseases where pain is a prominent symptom. These include neuralgia, migraine, bronchitis and other lung troubles, diabetes, renal diseases, bowel and rectal complaints, women's diseases, syphilis, etc. resulting in a constant addition to the number of habitues.

When we turn to the derivatives of opium, such as morphine, heroin, pantopon, etc., and other deleterious drugs like cocaine, which have since the world war been manufactured on a large scale for pecuniary gains, our difficulties become greater. Until the world war Great Britain, America and Germany were the greatest manufacturers of these alkaloids, but since then (thanks to the humanitarian efforts of English and American Societies) the Governments of the first two countries have entirely forbidden their preparation except for strictly medicinal use and within limited quantities. Unfortunately other countries have undertaken their manufacture and constant seizures by our customs indicate that factories in Japan, Germany and Switzerland now enjoy this unenviable reputation. In 1919 I calculated that 28 tons of morphine were smuggled during that year into China. I have no hesitation in saying that in

---

(5) German Plague Rep., p. 254.
(6) Jl. State Medic., 1925, vol 33, p. 278
(7) China Med. Jl., 1905, vol. 19, p. 80.
(8) Ibid., vol. 22, p. 225.

1924 not less than 30 tons were smuggled in. Thousands of morphine victims die yearly of neglect, starvation and septicemia induced by dirty needles. In the cities of Harbin, Changchun and else-where in Manchuria, we have to bury every winter hundreds of corpses with injection marks found on the wayside. Can you picture a more sorrowful state of affairs in this age of enlightenment and international co-operation? The worst of it is that the leading manufacturers and purveyors often move in the highest social circles, sometimes subscribe to charities, and enjoy the confidence—perhaps unknowingly—of responsible authorities. Heroin (i.e. morphine treated with acetyl chloride) is the most demoralising of the narcotics. Being three times stronger than morphine, a smaller dose produces the desired effect. It is mainly used as a snuff and therefore does not need any hypodermic syringe. Though not so strong a hypnotic, its psychical effect is far greater. It inflates personality, increases the sense of ability to do things, leads to recklessness and daring and obliterates all regret and sense of responsibility. It is therefore *par excellence* the super-dope of criminals. So great had its ravages become in America that Congress entirely prohibited the manufacture of heroin by Act of June 7th, 1924. Unfortunately this drug has found its way into China in large quantities, and a considerable proportion of recent crimes of violence in the treaty ports may be traced to it.

When estimating the immense harm done by narcotics we must not only think of immediate or direct effects. So often have I heard the question asked of medical men: "Do you see any pathological changes in the organs of opium addicts?" And the answer invariably was: "No, none visible." To ascertain the true morbid effects we should study the cases both clinically during life and pathologically after death. In the latter case complete miscroscopical examination should be made of important organs like heart, blood vessels, kidney, liver and nervous system. Furthermore, we should consider not only the individual addict but also the influence which he exercises upon his surroundings. Instead of being ashamed of himself he frequently attempts to obtain converts on the pretence of health preservation. Thus indirectly he is an opponent of public health measures. In addition the addict is untidy and unhygienic, bringing down his family including delicate children to his low standard of living-economic and hygienic. The rich smoker necessarily displays less obvious signs of degeneration than the average poor one who has to sacrifice food, home and other necessities of life to satisfy his craving. Such conditions are the precursors of slum life and attendant diseases (tuberculosis. syphilis, fevers). After all, the rich smoker is rare while the majority numbering at least 95% are poor. It is to help this majority to withstand the insiduous drug that our attention should be concentrated.

What then should be the attitude of the medical profession, especially those undertaking public health responsibilities? Should we remain quiet, as we have hitherto done, and leave the leadership in this work of rescue to lay people? Should we not rather display more activity in this direction? I contend that the narcotic problem is as

much a public health matter as the prevention of yellow fever and of malaria. In every case it should be tackled from the root of origin. As we drain swamps and thus remove the breeding places of Stegomyia in yellow fever, so should we appeal to interested governments to hasten their action for the suppression of the narcotic evils as provided in the Hague Convention of 1912. We lean nowadays upon the League of Nations to protect us from future wars and our women folk from being sold into the slavery of prostitution. We in the Far East depend upon the Epidemiological Bureau of Singapore to inform us as to the course of epidemics in these parts so that future outbreaks might be entirely subjugated. Should we not raise our voice against the evils arising from the traffic in debasing narcotics? I verily believe we should, and therefore I venture to appeal strongly to you for support in my resolution to be later submitted before the General Conference.

The Resolution reads as follows;

"That in view of the wide abuse of opium and similar narcotics in East Asia, the Far Eastern Association of Tropical Medicine, at its Sixth Conference held in Tokio, 1925, records its conviction as to the urgent need of limiting their production, sale and distribution to strictly medical and scientific uses."

BIBLIOGRAPHY :

British Malaya Opium Committee, Proceedings, Singapore, 1924.

Buell, The International Opium Conferences, World Peace Foundation Pamphlets, 1925, vol. VIII, Nos. 2-3.

Committee on Traffic in Opium, Foreign Policy Association, New York, International Control of the Traffic in Opium.

International Control of the Traffic in Narcotic Drugs, Washington, Govt. Printing Office, 1924.

Kolb and Du Mez, Prevalence and Trend of Drug Addiction in the United States, Reprint 924, Publ. Health Rep., May 23, 1924.

Kusama, Japan's Stand in Opium Problem, Japan Medic. World, 1925, vol. V, No. 6.

Manchester Guardian Weekly, April 24th, May 29th, June 5th, 1925.

Moore, Public Health in the United States, 1923.

Morphia and Narcotic Drugs in China, 1925, vol, V. No. 1 : An Imminent Menace.

The Traffic in Habit-Forming Narcotic Drugs, Hearings, before the Committee on Foreign Affairs, Washington, Govt. Printing Office, 1924.

Willoughby, Opium as an International Problem, Baltimore, 1925.

WU LIEN TEH.

QUARANTINE PROBLEMS IN THE FAR EAST.

(Being a paper read at the Pan-Pacific Food Conservation Conference, Honolulu, August 1924.)

The need of a uniform quarantine procedure throughout the Far East, nay the Pacific, grows in importance as communications become more frequent between the several countries concerned. This holds as good for food conservation as for human traffic. For a long time interested health officers working in the Pacific regions have watched with dismay the multitudinous laws affecting international health. Such laws, while unduly severe in some advanced countries, are altogether absent in others. Hence shipping companies, trade organisations and individual travellers have at one time or another suffered on one hand from laxity of health regulations leading to unnecessary infection and sometimes even death, and on the other from an over-rigid, at times purely theoretical, system resulting in panic and often entire stoppage of human and commercial intercourse over vast areas. The International Sanitary Convention of Paris (1911-12), even with its revised suggestions (1923), deals with only one side of the problem, namely, the protection of Europe from the East. Again, such a disease as plague is treated as a human instead of a rodent infection.

The establishment of the Health Section of the League of Nations with headquarters at Geneva has been justly acclaimed as a move in the right direction and the visit of a Health Commission to the Far East under Dr. Norman White in the early months of 1923 is a welcome sign that international health has indeed received the attention that it deserves. For it is obvious that in order to obtain the maximum of benefit for all countries the problem of international hygiene must be treated in the same way as communal hygiene, in other words each unit (in this case a country) should render its best so that the whole may succeed.

For the promotion of this high ideal no country will co-operate with greater zeal than China. Handicapped by the thoughts and practices of a 4000 years-old civilization, her modern public health officials have often had to fight a hard battle, but the task will be easier if she receives encouragement and co-operation from neighbouring countries possessing more complete organisations. Of the five dangerous communicable diseases, to wit, typhus, bubonic plague, cholera, small-pox and yellow fever, the first is principally found in the northernmost provinces, but only in a mild form; bubonic plague is confined to the two coastal provinces of Fukien and Kuang-tung; cholera is often non-existent; small-pox is almost universally endemic; while yellow fever has never been known to exist. The eradication of small-pox has been making considerable

headway during the last few years by extensive propaganda and free vaccination among the masses. The control of bubonic plague still awaits proper co-operation between the Chinese and neighbouring governments. The terrors of cholera have largely disappeared since Roger's treatment with hypertonic saline solution, which in our hands has saved 85% of the most severe cases. There is not much need to fear yellow fever, since it is a rapidly disappearing disease, thanks to the immortal researches of Walter Reed, Carroll, Agramonte, Gorgas, and Noguchi. Lastly, the origin of pneumonic plague, that most feared of all known diseases, has now been definitely traced to the Siberian marmot, and we express a hope that the temporary understanding between the Soviet medical organisation and our Service may soon culminate in a permanent agreement for the mutual protection of the two great republics, and therefore of the world.

To summarize then, if all emigrants from China are properly vaccinated against small-pox at their point of departure, the only disease which may be considered of international importance is bubonic plague, and the principal port from which this is conveyed is Hongkong. No standard yet exists for the treaty ports of China, by which one locality may exchange quick reports with the other for mutual protection. In order to clarify matters, a brief summary of the present quarantine problem in this country may be given.

The Chinese Maritime Customs have, since the introduction of quarantine laws in China, been the sole authority in the appointment of port health officers. The latter are usually busy foreign local medical practitioners, who as a rule do not examine any vessel until epidemic disease threatens or invades the locality. So far as the author is aware the following is a list of the principal ports showing presence or absence of quarantine hospitals :—

Port	*Port Health Officer*	*Quarantine Hosp.*	*Remarks.*
Shanghai (Woosung)	Yes	Yes	Whole time.
Hankow	Yes	No	
Canton	Yes	No	
Swatow	Yes	No	
Amoy	Yes	No	
Foochow (Pagoda anchorage)	Yes	Yes (small)	
Chefoo	Yes	No	
Tientsin (Tangku)	Yes	Yes (old)	Chinese M. O.
Tsingtao	Yes	Yes	Chinese M. O.
Newchwang	Yes	Yes (New 1924)	
Harbin	Yes	Yes complete with laboratory)	Manch. Plague Prev. Servic.
Dairen	Yes	Yes (do)	Japanese M. Oe.
Antung	Yes	Yes (complete 1924)	Missionary.

With the exception of Woosung, Tsingtao, Dairen, Newchwang, Harbin and Antung, no quarantine hospitals yet exist, though port health officers are appointed.

Although the Commissioner of Customs at each port, as representative of the Inspector General of Customs, is nominally responsible for its safety and as such issues instructions to the Port Health Officer, yet before any quarantine regulations may be enforced against any vessels flying a foreign flag, the permission of the local consular body must be obtained according to Treaty. Should any adverse vote be given by any consul, these laws cannot be enforced. Sometimes considerable delay is caused by reference to the respective Ministers Plenipotentiary in Peking or to the Diplomatic Body as a whole. In times of urgent stress, as in Cholera or Plague epidemics, such a procedure is suicidal from a health point of view. Besides, the quarantine laws of different countries are not the same and often lead to serious misunderstanding when applied.

Owing to the possible interference with routine commercial activities by the enforcement of quarantine laws in times of epidemic, it has often happened that reports of outbreaks among the population of one port are not sent to other ports, thus resulting in unnecessary spread of the disease. Within recent years, there have been a number of occasions when cholera was not reported until too late to prevent its spread by steamers to other ports. A mutual exchange of notes between responsible health officers will obviate this danger.

The most important ports of China, where quarantine hospitals, properly equipped with full time medical officers should be but have not yet been established, are Canton, Swatow, Amoy, Hankow and Chefoo. The expenditure at each place of Tls. 50,000 for construction and equipment and Tls. 20,000 for annual running expenses will be sufficient. The model of Newchwang may be followed with any modification necessary to suit local conditions. In the absence of epidemics, part of the hospital may be used for general cases, thus keeping the staff occupied. Health propaganda work should always be undertaken by the staff. In every case a limited accommodation for foreign patients should be provided.

The Chinese Government have often been blamed for not providing the necessary facilities for meeting such eventualities. In the presence of so many nationalities, each with its complex laws, and the limited powers of the Chinese executive, this blame is not always deserved. The time has arrived, in the opinion of the writer, for some steps to be taken to remedy this long standing evil.

To study the quarantine situation in China herself I have therefore proposed that a quarantine commission be appointed consisting of one representative from——

a. Minister of Interior (Nei Wu Pu), Peking.
b. Minister of Foreign Affairs (Wai Chiao Pu), Peking.
c. Chinese Maritime Customs.
d. United Foreign Chambers of Commerce in China.
e. International Health Board of Rockefeller Foundation.

This commission should visit the ports in question, study conditions at each place and recommend not only the establishment of such hospitals as may be required, but also study the financial aspect, so that as equitable and comprehensive a scheme as possible may be carried out without delay.

Next, the full Report of the commission should be submitted to the Central Government as well as to the Diplomatic Corps in Peking, and also the Health Committee of the League of Nations for approval and action.

The recent decision of the Council of the League of Nations to adopt Dr. Norman White's recommendation of a Far Eastern Central Epidemiological Intelligence Bureau at Singapore will assist my scheme by embodying all countries of the Far East. A detailed description of this proposed Bureau will be found in Dr. White's Report to the League of Nations submitted recently to the Health Committee (Geneva, 1923). A short summary of its functions may not be out of place here :—

1. Receive cabled information regarding infectious diseases.
2. Receive weekly reports of epidemic disease.
3. Classify ports as infected or suspected according to information.
4. Distribute weekly bulletins.
5. Exchange information with countries outside the Far East.
6. Report arrival and departure of infected ships.
7. Supply any other necessary health information.

The countries and dependencies to be invited to join this scheme are :

British India;
Ceylon;
Federated Malay States and Straits Settlements;
Dutch East Indies;
Siam;
French Indo-China;
Brunei;
British North Borneo;
Timor Dilly;
Philippine Islands;
Hongkong;
Macao;
Formosa;
Japan;
Korea;
China and the China Treaty Ports;
Russia;
and, less directly;
Australia and New Zealand.

Another interesting suggestion in Dr. White's Report refers to the grading of ports into First, Second and Third Class. The essentials of a First Class Port are :—

1. Presence of qualified and adequate health staff.
2. Adequate apparatus for fumigation of large vessels at anchor.
3. Trained staff for capture and scrutiny of rats.
4. Suitable quarantine station for deck passengers.
5. Adequately equipped laboratory.
6. Infectious Diseases Hospital.
7. A safe and adequate water supply.
8. Machinery for dealing with vital diseases, including dangerous communicable diseases.

A Second Class Port has all qualifications except 2 and 4.

A Third Class Port is one not included among the above.

The remarks I have made above are rather sketchy, but it is hoped that they may stimulate discussion from my learned colleagues so that the Pacific may for all time be truly so in health as well as in peace.

WU LIEN TEH.

THE HEALTH OF THE PEOPLE.

(Reprinted from the N. China Daily News 60th Anniversary Number July 14, 1924.)

Health conditions in China seem to be ever a source of anxiety to the rest of the world. And this notwithstanding the fact that quite a number of communicable diseases, like syphilis, scarlet fever and influenza, are of comparatively recent importation into the country. It is generally acknowledged that the black pox (syphilis) was introduced by the sailors of Columbus from Mexico and Central America into Spain in 1493, and thence into Italy and elsewhere, while scarlet fever was practically unknown in Shanghai until 1873, in which year the first cases were recorded.

But it is with present-day affairs that I intend to deal in this article. Though the history of public health progress in England may be said to have begun with the passing of the Sanitary Act in 1866 after unremitting labours by W. Farr, Chadwick and John Simon, and that in America with the triumphant passage of the Metropolitan Health Law (New York,) also in 1866, by Stephen Smith and Dorman Eaton, we are still waiting for "a change of heart" among the masses in China. The Chinese Classics are full of interesting points regarding the rules of health and correct living. It is perhaps due to such teachings, often handed down unconsciously from generation to generation, even among illiterate families, that the people have adopted the habit of tea-drinking, using the sunny side for dwelling quarters, wearing simple loose clothes, inoculation for small pox, and crude isolation for infectious diseases. A characteristic saying (醫學乃保全人命者) to be found in most ancient Chinese textbooks in medicine teaches that the object of medical science is to protect and preserve human life, which beautifully interprets the modern doctrine of public health.

Since the advent of the Republic in 1912, the Ministry of Interior has instituted a department of sanitation, containing a non-medical chief and about eight medical men. This department also runs the Government Isolation Hospital in the north city, Peking, as well as the Biological (Serum) Institute in the grounds of the Temple of Heaven, the latter being maintained by a grant of $110,000 from the Customs.

400,000 DOCTORS NEEDED.

On September 30, 1915 an important Presidential Mandate was issued recognizing western medicine as the proper standard of medical practice throughout the land. But as this was not followed up by a

Central Medical Council requiring official registration of medical students and practitioners, tens of thousands of old-fashioned and new-fashioned quacks may still be found sponging upon innocent persons. The problem, however, of supplying enough qualified doctors for China's four hundred million inhabitants is not an easy one. Great Britain with a population of 45,000,000 has 50,000 doctors on the register, while Japan with a population of 50,000,000 has over 60,000 doctors. According to western standards, at least one doctor is required for every 1,000 persons. To meet the needs of China, therefore, no less than 400,000 doctors are required! Where are these to come from? There exist 40 well equipped medical schools in Great Britain, whereas the number is less than ten in China. At the most liberal estimate, there are only 10,000 modern-trained practitioners in the whole of China. The majority of the people have to depend upon semi-trained druggists, herbalists, fire-eaters, amateurs, and any one who can read an ancient text. No wonder, the clever, if somewhat cynical, observation of a noted hygienist seems pertinent, when he says, "Out of one hundred persons who fall sick, 80 get well whatever you do to them, ten die whatever you do to them, and only ten may be said to recover through your skill."

Dr. Harold Balme, F.R.C.S., President of the Shantung Christian University, estimates that only eight out of every 1,000 sick in China ever reach the western-trained man, and because these are either surgical or advanced medical cases, only a limited percentage obtain complete relief. If China is to be made healthy from a national as well as an international standpoint, some other method than mere routine treatment of patients *after* they get sick is evidently necessary. Herein new public health ideas will come in handily. This brings me to some modern views regarding this question. As late as my undergraduate days at Cambridge (1896), whenever any sore throat, diphtheria or scarlet fever broke out, it was the fashion to "poke" the drains of the college, and if found choked, to clean them and perhaps pour some nice-smelling, much-advertised disinfectant into them. Our lecturer on Tropical Diseases at St. Mary's Hospital—a retired member of the Indian Medical Service—used to laugh at Ross's mosquito theory as to the causation of malarial fever, which he firmly believed to be due to the damp heat and peculiar humours of the Indian soil. The steady advance of bacteriology, especially between the years 1890-1910, and its practical application to health preservation have changed all this early pythogenic (filth) theory of the causation of disease. Instead, the germ theory is now thoroughly established, and we may base our methods of prevention upon three main lines of attack, namely through water supplies, insects, and direct contact. Let us deal with these in order. The principal diseases communicated by the drinking of polluted water are:—cholera, typhoid, dysentery and those arising from certain intestinal parasites. The adoption of great filter beds in water-works, sterilization with chlorine and regular examination of samples have practically stamped out these infections from large cities in England and America. In and around Shanghai, where the ignorant villagers still use the putrid water of creeks and ditches

for washing rice and vegetables, such diseases are often encountered, but may be prevented by intensive health propaganda, which will benefit not only themselves but also those to whom such vegetables and fruit are sold.

RAT FLEA AND MOSQUITO.

The number of insect-borne diseases in China is legion, and includes among others malaria (in all forms), bubonic plague, typhus, relapsing fever, sand-fly fever, perhaps leprosy, and certain affections of the skin. I do not mention yellow fever because although the particular species of mosquito (stegomyia) exists in abundance in China, that infection has never been imported into this country. It is now proved beyond doubt that malaria is carried by the mosquito (*anopheles*), bubonic plague by the rat flea, typhus and relapsing fever by the human louse. Prevention of these diseases means the eradication of the insect pests and their hosts. In the case of malaria, this is particularly difficult, because of inumerable ponds and rice-fields, upon which the sustenance of millions of Chinese depend. But not all mosquitoes convey malaria, and if some means could be found whereby the *anopheles* variety may be prevented from breeding, its extermination is merely a matter of time. The same may be said of bubonic plague, which is at present limited to the two coastal provinces of Fukien and Kuangtung (including Hongkong). In spite of successive outbreaks of the pest since the year 1894, and its spread to other ports of the world through Hongkong, not enough intensive study has been made of the rat and flea problem in these parts. If only a small fraction of the enormous revenue of Hongkong could be devoted to research in this direction by trained, independent observers, the history of bubonic plague may yet end in a happier chapter. The splendid work of Major Cragg (now, alas, dead as a recent victim of typhus fever) in India showed that two kinds of flea infest the brown rat, one of which (*Xenopsylla cheopis*) carries the plague bacillus, and the other (*X. astia*) does not. This accounts for the presence or absence of plague in certain well-defined zones of a plague stricken area. Such discovery will help sanitarians to concentrate preventive measures upon proper locations. In other words, haphazard methods will be avoided. Similarly, our researches upon pneumonic plague have resulted in an attempt to prevent its spread from the original focus in Siberia where the *marmots* suffer from periodical visitations of the pest, and not in wholesale prohibition of trapping of these animals, whose skins now fetch high prices in the market. By careful registration of hunters, by proper health teaching among them, and by disinfection of the furs before exportation, all possible dangers will thus be removed.

In the case of typhus and relapsing fevers, which prevail mostly in mining areas, a little attention to dwelling quarters, public bath facilities, and regular change and disinfection of their clothing will save much life and ill-health.

THE TERRIBLE WHITE PLAGUE.

Lastly, I come to that group of diseases spread by direct contact, among which may be included tuberculosis (in all forms), scarlet fever, measles, diphtheria, pneumonia, cerebro-spinal meningitis, infantile paralysis, encephalitis lethargica, syphilis, gonorrhoea, influenza, colds, etc. Few people are aware that of all afflictions in this world, including plague, earthquake, famine, floods, etc., not one claims so many deaths yearly as tuberculosis. It is next to impossible to collect statistics in China, but the figures of England and America may serve as useful guides. In the years 1850-59, the deaths in Great Britain from this disease numbered 27 per 10,000; since then there has been a steady decline, until in 1914 the figure was only 11. In America, the deaths numbered 23 per 10,000 in 1911; in 1922, these had fallen to 12.5. Our professors in 1899 used to say that one out of every seven deaths was due to tuberculosis. Thanks to better knowledge among all classes, this figure has now been reduced to under 11 in advanced countries. However, the mortality could still be reduced, if every one shouldered his due share of responsibility both at home and in the community.

In China, both rich and poor appear to be unaware of the ease with which tuberculosis could be prevented and even cured (in the early stages). To the rich, I would advise :—let children sleep in separate beds away from adults, open windows during the night as well as in the daytime, allow the sun to shine all day into the bedroom, as the sun's direct rays are the best disinfectant, keep the bedroom as bare of furniture as possible and have nothing (not even jewels or money) under the bed, avoid carpets and curtains. To the poor, I would say :—sweep the bed and floor at least twice a day; let the sun into the bedroom and place all impediments outside. When trouble comes to the lungs, neck or bone, expose the affected parts to the sun all day long, rest as much as possible and eat nourishing food. Drugs and medicines are of secondary importance. If schools of all grades give regular health lectures to be followed up at home as well, the number of sick students and consumptive scholars and officials would diminish correspondingly. Their outlook on life will also be more cheerful and their methods will follow a more practical course.

V. D. AND THE QUACK.

It would be futile for me in this limited space to speak of the other diseases of this group in such detail, but a few words may be devoted to the prevalence of venereal diseases in all the big cities of China. A glance at the advertisement columns of daily newspapers reveals an extraordinary number of would-be cures, especially for *hua-lou* (willow blooms). In the remotest villages, so-called modern drug stores exist solely for treatment with 606. In Harbin over one hundred small "hospitals" hang up their plates guaranteeing full cure with 914. Careful inquiries elicit the information that the charge for a cure ranges from $15 to $100, according to the social position or appearance of the

sick person, even if a slight rash or innocent ulcer may be the cause. That such a large number of shops ply their trade shows how profitable it must be. Such occurrences are but the superficial manifestations of western medicine unscrupulously applied, and with increased spread of a truer and higher aspect of medical science they will probably disappear. But it is necessary for those in authority to exert themselves, and to look upon popular health education as a very necessary item in their programme. In this respect, medical schools could take the lead by laying more stress upon the production of health doctors rather than mere practitioners, who trust to feeling the pulse, a few stereotyped prescriptions and a smooth tongue to making a living.

The public health nurse, who has proved so useful and essential in America, may with advantage be introduced into China. By her visits to needy and even wealthy families, much information is gleaned resulting in the saving of infant life, health to the mother, and greater cleanliness of the home.

More and more evidence is being brought forth showing that to obtain the maximum of benefit with the minimum of expense, personal hygiene is all important. When each individual of a community practises correct habits at home, he unconsciously repeats them among his fellows.

THE HOME HELPER OF SOCIETY.

Community hygiene thus follows family hygiene; in other words, the health of a people *en masse* is an index of their behaviour at home. Hence every effort should be made by those responsible to instill healthy habits among the inhabitants from their youngest days, to be continued at school, then at college, and lastly as responsible members of the general public. Government efforts have not been very prominent in this direction, but a band of keen enthusiasts have established the Council of Health Education and the National Medical Association, to forge ahead in public health reform among the people. The former consists of representatives from the National Medical Association, Medical Missionary Association, Kiangsu Educational Association, Nurses Association and Y.M.C.A. and is helped by funds from America and the Rockefeller Foundation as well as from the local bodies. Starting from a small show eight years ago, it has now grown into a strong healthy institution, sending lecturers and doctors to whatever schools that need their advice, and actually giving demonstrations in the prevention of eye troubles, which are present in 30 to 40 per cent. of the students examined. With increased popular support and government patronage, these Health Associations are bound to do immense good and help to arouse the sanitary conscience of the masses, which has remained rather dormant during the 30 years that the west has made such remarkable progress.

It is not only the young who require protection. A casual estimate of the causes of death among prominent men I knew in China during recent times brings this out clearly. President Yuan Shih-kai, who died

prematurely at 55 of kidney trouble, had been a colossal eater at all times of the day and a few months before his death had slept badly and worried greatly. The late Viceroy Yang Shih-hsiang of Chihli, who always refused to moderate his eating habits when well, died at 56 also of nephritis. Governor Chen Chao-chang of Kirin used to drink whole quarts of Shaoshing wine with meals and died before 55 of hardened arteries. Another Governor passed away at 52 a short while ago with tuberculosis brought on by insufficient access to fresh air. Quite a number of prominent men and familiar friends of mine are daily consuming quantities of "strengthening medicine" in the form of jinseng, deershorn, etc., to stimulate their jaded appetites, instead of eating less and sleeping more. Perhaps after a few more lessons, our wellknown people will trust lives and health to trained experts who have made a special study of their subject rather than to quacks and out-of-date text-books, as they do at present. Most of all, they will learn that good health pays better dividends than any profit-sharing company, in that it will add a considerable number of years for them to enjoy this beautiful life.

WU LIEN TEH.

THE INFLUENCE OF THE CHINESE DIET ON DISEASES.

Reprinted from the China Med. Jl., Vol. XXXIX, No. 11, 1925.

In a former article,[1] the author tried to draw attention to the difference in the incidence of certain diseases between Chinese and Europeans. It was pointed out that the simple life, sensible clothes and plain food of the Chinese people may have some influence and may even explain some of the observed data. It is here proposed to set forth the attractive theme, namely that some common diseases among the Chinese may be due to diet. Reversely the absence of certain diseases may be accounted for by the nature of the food of the people.

First of all, let us examine the food of the common people of north China. It must be stated at once that it is almost entirely vegetarian and monotonous in the extreme. The small merchants and coolies eat boiled kaoliang, some vegetables fried with soya bean oil and bean curd in the morning. In the evening they eat man-tou (bread made of wheat flour), vegetables in season, bean curd, and fun-tiao (vermicelli made with peas).

On the 1st and 15th of the month and at festivals the merchant class eat meat in some form, while the labouring class rarely eat meat, fish or eggs. Cow's milk is never used of course. That they eat only twice daily, (though some are better off and eat thrice daily), that they have heavy work to perform and that the vegetarian diet is not sustaining means a bulky and large amount of the food ingested. To eat eight man-tous at a sitting is quite an ordinary feat.

Hutchison[2] calculates that a vegetarian should consume about 2960 grms. (6½ lbs.) of cooked food daily. Seeing that the total capacity of an ordinary stomach is only about 1200 grms. (2 3/5 lbs.) this means that it must be filled to the limit of its capacity thrice in the day, or even over the limit if there are only two meals a day.

In passing one may refer to Adolph[3] who found on investigating the food of the middle class of north China that the fuel value per capita for 60 kg. body weight amounts to 3355 calories of which 87% were furnished by cereals. The Occidental standard for 70 kg. body weight for moderate muscular work is 3500 calories and for light muscular work 3000 calories. The amount of protein ingested per capita is found to be 111 grms. of which only 5.3 grms. are animal in origin, a strong contrast to the diet of the Occident where about 50% of the total is of animal origin. This amount of protein approaches very nearly to the standard of Voit, 118 grms., but it is only the amount ingested and not the amount digested, a difference of perhaps 30%. Adolph maintains that the food consists of 94% of "vegetables," and

that in consequence almost all the protein, fat, and carbohydrates are derived from them.

Connected with all these draw-backs, one may trace the prevalence of many diseases in China.

That tuberculosis is wide spread and that it is partly due to under-feeding is undeniable. The absence of animal protein and the small amount of fat in the diet are predisposing factors.

It is generally believed that a strict vegetarian aliment tends to diminish energy both mental and physical, as well as the power of resistance to diseases. Moreover, a meat-eating nation is more aggressive. These facts may explain the character of the poor class of people who are not energetic nor aggressive generally speaking, though they have endurance and patience. The stature of a nation is affected by the kind of diet it adopts. Vegetarian peoples are shorter than those who subsist on a well mixed diet. This point will be referred to later.

The bulkiness of the vegetarian diet leads sooner or later to derangement of the stomach and bowels. As a result we see many gastro-intestinal diseases. During the last 2½ years there were 29,552 out-patient visits to the Harbin Hospital and out of these, 2,357 were for diseases of the digestive system. There is no doubt that there are many cases of dyspepsia and dilation of stomach among our patients.

The prevalence of fistula in ano may be accounted for by the coarse and bulky food. The bowels are relieved only when absolutely necessary; the large stool and the coarse ingredients tend to cause abrasion of the mucosa of the rectum, thus favouring infection by bacteria. An ischiorectal abscess is formed and a fistula is the result.

The Chinese have a proverb—ten men, nine piles. This shows the extent of this complaint. The term piles here includes fistula. Out of 738 Harbin Hospital in-patients as recorded in the 4th volume of the North Manchurian Plague Prevention Service Report, there were 40 cases of piles and 51 of fistula in ano.

We need only mention shortly here the fact that there are large numbers of sufferers from beri-beri in south China and middle China where people subsist largely on a diet of polished rice. Neither need we dwell on the occasional appearance of pellagra and scurvy which are met with especially in times of famine.

Turning to the other side of the question, the children of the poor people are breast-fed whenever possible. If the mother dies, babies are put on a diet made of rice gruel. The children are weaned very late, for it is quite common to find a mother giving her breast to a child of three years or even older. Universal breast feeding is a good national custom and in consequence many ills from artificial feeding are thereby avoided. The most noticeable feature is the rarity of rickets, a disease which is so prevalent in the slums of big English cities.

Diabetes is not rare among the well-to-do class; it is generally discovered during a physical examination of persons for life insurance companies. But it is not frequently met with among the poor. Our figures

give 0.09% of out-patients, while Osler quotes 1% admission figures for John Hopkins hospital, for a period of 22 years.

The same authority quotes Von Noorden who stated that the statistics for London and Berlin show that the number of cases in the upper ten thousand exceeds that in the lower hundred thousand inhabitants.

Summarising shortly from the records of our hospitals, one is struck with the comparative infrequency of the following diseases, appendicitis gastric ulcer, gastric cancer, gout, ordinary rheumatism, gall stones, renal stones and obesity.

It may be justifiable to assume that the abstemious nature of the Chinese diet, consisting as it does chiefly of vegetables, has considerable influence on the prevalence or rarity of certain diseases. We may say in general that the diet is not over-rich or over-taxing to the system as in direct contrast to the diet of many Occidental countries where certain people dig their graves with their teeth. This then is the explanation of the difference in the incidence of diseases which have connection with the alimentary, vascular, excretory, and central nervous systems.

There are disadvantages, however, in the Chinese diet. Its bulkiness has already been pointed out. Though the amount of protein ingested seems to be adequate and though the soya bean acts as an excellent substitute for meat and milk,[4] yet the small amount of animal protein. probably also of fat soluble vitamine A is undesirable,[5] for it lessens efficiency and vigour. The "Specific dynamic action" of protein is well known, and the lack of it may tend to affect the temperament of the people.

McCollum[6] went further by stating that "those peoples who have employed the leaf of the plant as their sole protective food are characterized by small stature, relatively short span of life, high infant mortality and by contented adherence to the employment of the simple mechanical inventions of their forefathers......"

All the same, it must be asserted that other factors, climatic, religious, social and political, have also their share in the formation of the character of a nation.

At any rate, the diet of the Chinese, adopted for centuries, must be sufficient in all essentials and suitable to the prevailing conditions. For the physique especially of the northern Chinese is good, the stock is healthy and fruitful, and the people constitute, as is alleged, a third of the population of the world.

REFERENCES.

(1) National Medical Journal Vol. X, No. 3, June 1924, p. 159
(2) Hutchison—Food and Dietetics p. 180.
(3) China Medical Journal, 1923, p. 1013.
(4) National Medical Journal 1920, p. 40.
(5) China Medical Journal 1922, p. 136.
(6) McCollum—Newer knowledge of Nutrition p. 151.

J. W. H. CHUN,
(*Senior Med. Off. Harbin*).

ON ANTIRABIC MEASURES AND THEIR PRACTICAL APPLICATION.

Reprinted from the National Med. Jl. of China, Vol. X, No. 5, 1924.

Rabies has been known for very many years, and been studied in great detail by many investigators but there is still great disparity of opinion as to the nature of the cause, and sometimes of the treatment. Hydrophobia or rabies is a specific infectious toxic disease to which dogs, wolves, skunks, and cats are highly susceptible. Through their saliva it can be communicated to men, horse, cows and other animals. The means of communication is almost invariably a bite. However, it is the dog that is the common distributor and to which attention must be directed.

Diagnosis of Rabies.

There are two means of arriving at a diagnosis of rabies in cases of suspected mad dogs :—

1. When the animal has been killed.
2. While the animal is still living.

I. The first lies in :

A. The examination for the Negri bodies.

The methods for this examination are highly important and should never be omitted. As generally conceded, the discovery of these bodies in the cells of the central nervous system may be taken as possible evidence of the existence of rabies in its transmissible stage. The examination is always made at once by smear preparation or section of the brain. The examination and staining of such specimens are difficult and always done by specially trained men. However, there is an easy method : "Small portions of the gray substance are removed from the cerebral cortex in the region of the crucial sulcus, the cerebellar cortex, and the hippocampus major. These are crushed on a slide and a smear made by means of cover-glass. The dried smears may then be stained by Giemsa or by Lowden's method, i.e. 10 c.c. of distilled water to which 3 drops of a saturated alcoholic of basic Fuchsin and 2 c.c. of Lœffler's solution of methylene blue are added. The smears are fixed in methyl alcohol for one minute. The stain is then poured on, warmed till it steams, poured off and the smear is rinsed in water and allowed to dry." According to Drs. Williams and Lowden(1) Bodies are found before the beginning of visible symptoms,

(1) The Jl. of Inf. Dis. Vol. III 1906 19.

i. e. on the 4th day in fixed virus, on the seventh day in street virus. The structure of the nucleoli of the nerve cells resemble Negri bodies and special staining of the nucleoli is also the same except that the position of each is different. A Japanese investigator says[(2)] the situation of the Negri bodies in the early stage is always near the membranes of the nucleolus and in a later stage is away from it

B. Inoculation of rabbits.

This is only necessary in highly suspicious cases in which no Negri bodies are found. A bit of the fresh nervous tissue is made into a creamy suspension, by adding physiological salt solution, crushing and grinding in a small agate mortar, finally filtering through gauze. One or two drops of the suspension are injected beneath the dura mater or deeply into the brain tissue. If the operation be successful, the wound heals and no meningitis follows. At the end of a week the rabbit becomes paralyzed—"dumb rabbit." 2 or 3 rabbits should be simultaneously inoculated, in case a single rabbit develops meningitis, through accident or bad technic. The rabid rabbit dies in a day or more after the onset of the palsy, and Negri bodies will be found in the brain tissue, which can be used for infecting other rabbits in endless series.

C. Examination for histological changes in the ganglia.

These are now rarely looked for, the chief changes being in the Tubercles of Babes.

2. *While animal is still living* :—

This method is very simple. Keep the suspected dog in a cage for at least a week under observation and watch him for any signs of the disease. The first stage usually lasts from one to three days. Two varieties may be noted in this stage-mad and dumb. In the former, the dog runs about snapping at objects and other animals, unable to rest; later (2 to 6 days after) which is also the final stage of the mad type, the limbs become paralyzed, and the dog crawls about or lies still. There is also great difficulty in swallowing either food or drink, the breathing becomes difficult and the dog dies of exhaustion in about one week's time.

Principle of Pasteur and other treatments of rabies.

The method of Pasteur and other treatments are based upon the principle of stimulating with attenuated or modified virus during the period of incubation, so that the virus introduced into the wound is destroyed, or neutralized. Owing to the uncertainty or irregularity of the inocula-

(2) Jap. Fuchuko med. Jl. No. V. Vol. 14, Dec. 1923.

tion period (10 days to 27 months) and the delay caused by laboratory examinations, the Pasteur treatment should be commenced as soon as possible without waiting for a laboratory report. The said treatment is quite safe if applied properly. Pasteur worked out this theory and established its truth by experiments upon the lower animals before applying the treatment to man. The administration of Pasteur's vaccine requires numerous injections with materials of varying virulence.

PREPARATION OF THE RABIES VACCINE.

In turning to the method of preparing the anti-rabic vaccine, it is necessary to prepare or obtain "fixed virus." This may be prepared by passing street virus from the medulla of a rabic dog through a series of young rabbits. For this purpose 0.1 or 0.2 hippocampal tissue of the dog is made into an emulsion with salt solution or bouillon and injected subcutaneously into a rabbit and upon its death the spinal cord is removed. A similar emulsion is made with a fragment of it, and a second rabbit inoculated, and so on through the series until a standard virulence is obtained. After from 30 to 50 passages the inoculation period is gradually reduced to only 6-8 days and this is said to be "fixed virus." This usually requires a long time (one or two years), so the best way is to obtain "fixed virus" from a laboratory. The rabbit which received an injection of fixed virus becomes completely paralyzed after 6-8 days; it is killed and its spinal cord is removed and cut into 3 pieces. A small piece is cut off the upper end of the upper portion and placed in bouillon or agar or gelatine and incubated as a test for sterility. The cords are hung in the drying bottle over sticks of caustic potash or calcium chloride. Place the bottle in a room with a temperature of 20°-23° C. The longer the cord dries, the more the virulence attenuates. When the cord has reached the necessary attenuation, say one to fourteen days, then transfer to sterile glycerin for preservation. The dried cords should be marked 1, 2, 3, days and so on. When required, 1.c.m. of the dried cord is emulsified with 30 c.c. of sterile 0.8% salt solution, filtered through gauze and then injected subcutaneously. The preparation can be used with perfect safety for 1 to 3 days if kept cool, or it can be preserved with the addition of 0.25% phenol.

About 4 years ago a Japanese investigator, Dr. Ashida, employed a strong fixed virus for human prophylactic treatment which proved to be a safe and efficient antirabic vaccine. The method is very simple and any one can apply it[(3)]. "The whole brain and the spinal cord of a rabbit, in which rabies has been made to develop in 7 days from the injection of the fixed virus, were collected and ground up together. To this mass 4 times of its volume of 0.5% phenol solution were added. This mixture was called the original vaccine. It was still further diluted to a 1/5th dilution with 0.5% phenol solution.

(3) Jap. Chipa Med. Jl., No. 91.

For a man bitten by a suspected dog, 2.c.c. of the diluted vaccine is injected hypodermically. Continue 10 to 15 injections or use 2.5 c.c. for 12 continuously. No ill effects are observed." Moreover, he says

that he has applied this treatment to 649 patients and only one case developed rabies i.e. 0.15%. Another simple method for prophylactic treatment is that of Semple[4], who takes the medulla of rabbits which have died after inoculation with rabies, and makes thereof an 8 per cent dilution in normal salt solution, to which 1% carbolic acid has been added. This dilution is then kept for 24 hours at 37°C., diluted with an equal volume of sterile normal salt solution, and stored in a cool place away from the light. Semple has shown that this 4% dilution in 0.5% carbolic acid normal salt solution is a safe and efficient vaccine for immunization of any susceptible animals like dogs, and rabbits, etc., against subdural inoculations with virulent living virus. The serum of inoculated animals gives a well marked anti-rabic action on living virulent virus, and it would seem that this should also prove to be a safe and efficient anti-rabic vaccine for the prophylactic treatment of persons bitten by rabid animals.

There are still other new and simple methods by Babes, Puscarin, with heated or diluted vaccines, anti-rabic serum, etc., but the results in general have not been uniformly encouraging. We have just now commenced to carry out in our Laboratory some of the new methods to determine this question and will report later on. As mentioned above there are many different methods for applying anti-rabic vaccine, but I consider it wise to use Pasteur's original one. According to reliable statistics, the mortality of rabies with the treatment of Pasteur (original) gives an average mortality of only 0.46%. Regarding the prophylactic inoculation of dogs, I should say that the Umeno method is the best, and I am sure it would protect the dog from developing Hydrophobia.

CONCLUSIONS.

A. All rabid animals should at once be killed except for purposes of observation, and all animals known to have been bitten by them should also be destroyed.

B. Introduce laws by which dogs should have prophylactic inoculation as recommended by a Japanese Veterinary surgeon. Dr. Umeno. This is as effective as prophylactic vaccination against Smallpox in man.

C. To prevent rabies, means must be devised to prevent dog bites since the virus is no doubt contained in the saliva of the rabid animals, and infection is only possible when the skin is damaged by bites and scratches. Hence dogs without owners or stray dogs and cats should be destroyed or muzzled.

---

(4) Scientif. Memoirs of the Govt. of India, No. 44.

D. Any one bitten by a dog should at once consult his physician, and whenever necessary a course of prophylactic injections should be given. This method of procedure has been proved by world-known investigators, like Pasteur, etc., to be quite safe.

E. As genuine rabies is an acute infection in which the diagnosis and prophylactic treatment are readily obtained, every big hospital in cities should provide fresh material at all times for this purpose. In China there is undoubtedly an increasing number of cases of persons bitten by rabid animals. In a big town like Tientsin with 1½ million inhabitants there are only two hospitals which can undertake the diagnosis or give prophylactic injections. Of course, it cannot be said that our Government ignores the dangers arising from the problem of uncontrolled mad dogs. The fact is our medical men have not paid sufficient attention to the matter. The subject of the present paper is to encourage our countrymen to adopt up-to-date measures for the prevention of rabies and also for mutual protection among members of the community.

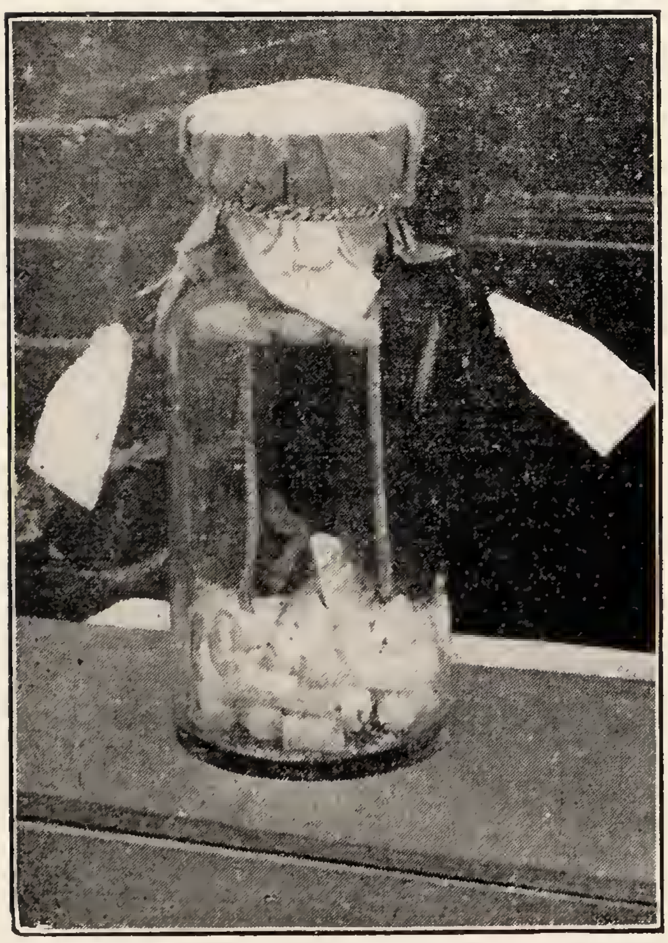
LIN CHIA SWEE, M.D.,
Senior Medical Officer.

Showing the removal of the spinal cord from a rabbit.

由兎取出腦脊髓之法

Showing the method of injecting the medulla emulsion beneath the dura mater.

硬腦膜下注射腦乳劑之法



Showing method of drying the spinal cord of rabbit for the purpose of attenuation.

乾燥兎的脊髓之法

Showing complete paralysis six to eight days after the injection of fixed virus beneath the dura.

注射固定毒於腦膜下第六至第八日全身痲痺

Association of Museums Medical, 1926).

REMINISCENCES OF SIR WILLIAM OSLER IN ENGLAND.

Reprinted from the Memorial Volume of Sir William Osler (International Association of Medical Museums, 1926).

At the last moment, owing to an accidental meeting with one of the Editors at Baltimore, I have been asked to write a few words about my connection with Sir William Osler in England. It began in this way.

The great Manchuian Epidemic of Pneumonic Plague, 1910-11, killing nearly 60,000 persons in Manchuria and North China within the course of five months, had just been eradicated, and at the invitation of the then Imperial Chinese Government, scientists from eleven countries were sitting at Mukden (capital of Manchuria) to discuss the epidemiology and future methods of prevention of this terrible disease. Among letters received by me as President of this Conference was a very kind one from Sir William Osler, who had just received a baronetcy at the coronation of King George V. of England. Sir William congratulated the Chinese doctors on their splendid fight against the plague, and requested me to supply him with the clinical and pathological aspects of the disease which up to that time had been so little known. I gladly complied with the wishes of so eminent a man—perhaps the most renowned of all English-speaking physicians then living. The little information so supplied promptly appeared in the next edition of his famous Principles and Practice of Medicine, which had already been translated into Chinese and other foreign languages.

Thus started a correspondence between Sir William Osler and myself which, though infrequent, was regular, and these letters are now among my most treasured possessions.

When Sir William learnt that I was attending the Hague Opium Conference in 1911-1912 as a delegate of the Chinese Government, he invited me to visit him at Oxford, where he had been Regius Professor of Medicine since 1905. At the earliest opportunity, I proceeded to that ancient English seat of learning, and for the first time met my distinguished friend face to face. He was all that I had expected of him—and more. Though always busy, he never seemed to be in a hurry or anxious to get rid of you. For a great man he was modesty itself, and whenever he asked questions about my country or my work it was with true humility. But I soon found out that he had read widely about most lands, and knew more than he cared to confess. Confucian philosophy interested him as much as the incidence of pneumonia and diabetes among oriental people, and I often found myself hard-pressed on matters relating to the history of medicine in China. When he placed me in a fix, his hearty laugh, so

well-known, at once came to rescue and I immediately lost my embarrassment. Osler's knowledge of the comparative history of medicine, especially of medieval Europe, was indeed profound, and I was not surprised that in his later years he devoted much time to the encouragement of a more intensive study of the subject. Few will contend that the wonderfully efficient Museum of Medical History, first located in Wigmore Street, and now removed to Endsleigh Gardens, in London, owed a great deal of its success to the unstinted help given by Osler to Mr. Henry Wellcome, the founder, and Mr. C. J. S. Thompson, its life-long Curator. While at Oxford, I was also introduced to Lady Osler and their only son, a very promising lad, who alas, was so soon to lose his life in France (1917) during the World War.

It is generally acknowledged that the appointment of Sir William Osler to "sleepy Oxford" (as we rival Cantabs are so fond of dubbing our senior sister 'Varsity) meant a distinct awakening of not only the medical but also the scientific departments. His enormous prestige as the leading clinician of the English-speaking world and his unrivalled experience as a teacher and organizer at Montreal, Philadelphia and Johns Hopkins, as well as on the Continent, paved the way for loyal co-operation from all sides. Even the most conservative "don" must have felt that a master-giant of medicine had indeed come. Add to this his unfailing geniality and bonhomie, which won him the affection of both graduates and undergraduates from all lands, including the Orient, and one can picture the beneficial influence exercised by him during the fifteen yeas of his stay at the University. I was invited one day by Sir William to accompany him around his wards at the Radcliffe Infirmary (Oxford) in the company of a few senior students. There he was, standing upright with his left hand in his trousers-pocket and the right smoothing down his long moustache (which, by the bye, he allowed to flow down in the Chinese style and not twisted up a la Kaiser as was then the vogue), combining humour with affected severity in the asking of questions and always insisting upon the full employment of common sense on the part of the student when examining a patient. No wonder both well and sick loved the kind professor, looked eagerly forward to his next visit, and in after-life remembered his cheerful words after all else had been forgotten.

In August, 1913, came the great International Congress of Medicine attended by seven thousand physicians from every part of the world. Sir Thomas Barlow was the President and Sir William Osler one of the Vice-Presidents. I attended as the principal Chinese Government representative and along with about twenty other delegates was asked to make a speech of welcome at the opening session. It was a hot morning, and almost every one had prepared a set speech. The Albert Hall was large and rather noisy with its ten thousand occupants; the platform was situated at one corner of the huge building. Only the speech of Sir Edward Grey (then Secretary of State for Foreign Affairs) was heard, though indistinctly. Next came the formal addresses from the

foreign delegates. The first man took half an hour, the second twenty-four minutes, the third eighteen minutes, and soon impatience was shown by the audience. But the delegates seemed unwilling or unable to cut down their speeches. More noise, coughing and impatience. Then came my turn. "China thanks you," I said, and sat down. The ovation I received was the biggest in my life. In fact the cheering lasted four times as long as my speech. The other speakers who followed took the hint, and so only half an hour more was consumed before the morning's programme terminated. Osler was the first to burst in upon me. He seized my hand and offered his heartiest congratulations. "You are a capital psychologist" were his words.

Two evenings afterwards, Osler was host to a party of twenty-four foreign guests at a dinner at the Royal Societies' Club. At least a dozen nationalities were presented, and I found myself in the company of Ehrlich, Hata, Abderhalden and others. None of the numerous parties that were held during that memorable week could have been more enjoyable than ours, and certainly no host was more entertaining or more considerate toward the majority of strangers assembled. Next year the War came, and because of his added duties and family anxiety no further correspondence passed between us.

If I may conclude my estimate of Sir William Osler in one sentence it is this : "He was a great man, a unique teacher, a complete physician, a fine judge, a lovable friend, an accurate historian and an unrivalled conversationalist."

Wu Lien Teh.

MODERN CHINESE PHYSICIANS AND PRACTICE.

(Reprinted from the China Mission Year Book, 1926.)

Modern medical practice in China may be traced to the year 1807, if not earlier during the period of the East India Company, when Dr. Pearson first introduced cowpox vaccination into Canton. In 1836 Dr. Peter Parker, an American missionary, opened the first hospital in China, again at Canton. When Hongkong was occupied by the British in 1841, the establishment of a hospital for the fighting services and one for civilians the year after was natural. Shantung Road Hospital in Shanghai was founded in 1846 by Dr. William Lockhart of the London Mission Hospital. In 1861, when medical services in Peking were needed, Lockhart was transferred to the capital, and here he established a temporary hospital within the precincts of the British Legation. Years later, when expansion became necessary, new land was bought in the city, and a permanent home for the treatment of patients was built on the site known at present as the Lockhart Hall of the Peking Union Medical College.

Kwangtung being the first Province to be associated with foreigners, it is not surprising that the Cantonese were the first to benefit by western medical practice and that they were also among the first students to enter the profession. For several generations the Kwans have been known in the medical line, and the first medical student to study in Scotland was Wang Fen (about 1850). A few years afterwards, Ho Kai (afterwards the Honorable Sir Ho Kai) studied at St. Thomas's Hospital in London and after his wife's death founded the Alice Memorial Hospital in Hongkong. Sir Patrick Manson's discovery of the filaria as the cause of elephantiasis while practising in Amoy and Dr. James Cantlie's enthusiastic management of the Hongkong College of Medicine (1888-1898) attracted a large number of brilliant Cantonese to the medical profession. At that time, there was still much prejudice against western practice, and it was not uncommon to hear the most fantastic stories about the 'foreign' hospitals using children's eyes and hearts for the manufacture of pills and gelatine capsules (evidently because of the shining lustre of the latter). Until recent years, modern practitioners were consulted only as a last resort, and only dying patients

When Viceroy Li Hung Chang established the Peiyang Medical College in Tientsin in 1893 and requested Dr. Kenneth Mackenzie of the London Missionary Society to manage it, he could only obtain Cantonese students, and these were mostly recruited from Hongkong, for there only could the required standard of English be attained.

were sent to hospitals in Hongkong, in order to obtain the necessary death certificates, because native practitioners were not allowed to issue such things.

It may therefore be expected with the above background that in medicine, as in other modern activities, such as railways, banking, steamships, the Cantonese have played the most prominent part in its history and progress. Let us now deal with the matter more concretely.

Towards the winter of 1910, a severe outbreak of plague was reported from Northern Manchuria, and the then Manchu Imperial Government appointed two western graduates of medicine to proceed thither without delay and devise methods of prevention. Of these two doctors, one was from Fukien and the other from Canton. The former refused, but the latter proceeded at once and reached his destination within four days after receiving orders. There he found much chaos, ignorance and opposition, but he brushed them away one by one, and among other things persuaded the conservative government to agree to the cremation of thousands of corpses within a few days, to support him in a radical campaign against the dreadful pest, such as, house to house inspection, strict hospitalisation of the sick, confinement of contacts, burning of the dead, etc. By this means, the plague was stayed, and although 60,000 lives were lost altogether in Manchuria and North China, it was prevented from invading other countries. Chinese preventive medicine thereupon received a great fillip, an International Plague Conference was held at Mukden in April 1911, at which experts from eleven countries attended, and the presiding officer was a Chinese physician trained in the best university and research laboratories of England, France and Germany. As a result of that Conference, the Manchurian Plague Prevention Service was established in 1912 with hospitals at Harbin, Manchouli, Sansing, Lahasusu and Taheiho, extended in subsequent years to other cities, such as, Newchwang, Antung, Hailar and Tsitsihar. The initial funds for the erection of the hospitals amounting to over $180,000 came mostly from the local Manchurian government, while the annual appropriation of $120,000 for maintenance is defrayed from the Maritime Customs. Apart from its strictly anti-plague work, this Manchurian Medical Service has accommodation for other communicable disease, like Cholera, Small-pox, Scarlet Fever, Typhus, etc., does the routine hospital work of a city by treating medical and surgical cases, manufactures sera and vaccines for plague, cholera, rabies, scarlet fever, etc., performs chemical and bacteriological analyses on foodstuffs, water, etc. and advises the local municipal administrations on health matters. In other words, its duties include practically all those usually undertaken by a modern health department with the addition of general hospitalisation. Research work on plague, scarlet fever, parasitic diseases of all kinds is actively pursued, and the four bulky volumes of Reports already published bear witness to the amount of solid scientific work already accomplished by this Service.

In 1918 Pneumonic Plague again appeared in North China, this time in Shansi along the Peking-Suiyuan Railway. Fortunately the

region traversed by the epidemic was sparsely populated and sufficient medical assistance was rendered in time, so that only 16,000 persons fell victims to the scourge. It enabled the Central Government to utilise the balance of the one million dollar loan from the Group Banks for the establishment in 1919 of the Central Epidemic Bureau at the Temple of Heaven. At this Bureau, vaccines and sera for Smallpox, Diphtheria, Scarlet Fever, Typhoid Fever, etc., are manufactured for distribution throughout the country, and the ordinary functions of a Public Health Laboratory are performed. The annual appropriation of $110.000 is obtained from the Maritime Customs.

In 1920-21 Pneumonic Plague again invaded Manchuria from Siberia, but thanks to the vigilance of the medical personnel and the close co-operation between the Chinese, Russian and Japanese railway lines, the spread of the epidemic was limited, and less than 9,000 persons died throughout Manchuria and Siberia. During this outbreak, most valuable research upon the plague and its origin was carried out by the Chinese medical staff.

In the meantime, considerable progress had been made in other parts of the country. The fact that western trained Chinese physicians had been able to put a stop to such a fatal disease as pneumonic plague in a short time while the old fashioned ones failed considerably influenced the conservative scholars and merchants in adopting a more rational attitude toward modern medicine. Although they still hold that internal diseases are peculiarly obedient to the ripe experience (?) of the native practitioner, the masses are now ready to admit the superiority of western surgery in removing tumours, amputating useless tuberculous joints; of modern anti-syphilitic injections with 606 and 914 (in fact they are at times too ready to receive such treatment and therefore fall ready prey to unscrupulous ex-dressers and bottle-washers by paying for simple coloured solution); of the advantages of modern health campaigns against infantile mortality, tuberculosis, flies and insects as causes of disease, etc.; of systematic vaccinations against smallpox, etc.

Trained midwives are in greater demand in the cities, and as a result, there are fewer cases of puerperal septicemia and infant ophthalmia. But the supply is still insufficient, and it may be that our strict policy of the past to raise qualifications to the level prevailing in more developed western countries will have to be modified so as to meet the pressing needs of China.

In the summer of 1914, just when the guns commenced to boom in Europe and announce the beginning of the World War, a body of young Chinese doctors, including Drs. Wu Lien Teh, (Peking), E. S. Tyau (Shanghai), F. C. Yen (Changsha), Mary Stone (Kiukiang), Ida Kahn (Nanchang), C. V. Yui (Shanghai), and a few others met at a restaurant in Shanghai and decided to start the nucleus of the National Medical Association of China. Two hundred dollars were subscribed on the spot as initial expenses for printing, employment of a clerk, etc. Dr. F. C. Yen was elected as President, while Dr. Wu Lien Teh volun-

teered to act as Secretary. A quarterly journal, called the National Medical Journal of China, was forthwith published in two languages—Chinese and English. Five hundred copies of the first issue were printed and sent to possible members. The membership was to be limited to properly qualified practitioners of medicine. By next year, when the first full Conference was held in Shanghai, the number of members had been increased to 300. In 1917, when the Association met in Canton, the list had expanded to over 500 names. Since that time the number had swung between 540 and 600, and for four years now we have printed one thousand copies of the journal, now bimonthly instead of quarterly. A substantial income is received from the large number of advertisements appearing in its issues.

The National Medical Association comprises practically all medical graduates who have studied in European and American colleges as well as medical schools in China recognised by the government. Another Medical association—the Chinese Medical and Pharmaceutical Association—comprises graduates from Japanese medical colleges as well as colleges in China influenced by Japanese teaching, and has about one hundred and twenty members. Although our organisation is still not quite perfect, it is hoped that during the next three years the membership of the National Medical Association will have increased to nine hundred and that permanent head quarters will be acquired in Shanghai to meet our growing needs.

Since its foundation, these two Medical Associations have co-operated with other bodies interested in scientific nomenclature and published a series of medical terms now officially adopted by the Ministry of Education. Together with the Y.M.C.A., and five other organisations, they have formed the Council of Health Education for the promotion of Health Education throughout the country. For a time the National Medical Association was the mainstay of the National Health Movement under the leadership of Dr. S. M. Woo, a graduate of Johns Hopkins. Recently, the two leading Medical Associations have again united in launching an appeal to the British Boxer Commission under the chairmanship of Lord Willingdon for the apportionment of £100,000 yearly (one-fourth of the total annual funds) for five years for the promotion of Public Health in China including the endowment of health lectureships in medical colleges and high schools. This need is based upon both humanitarian and economic reasons. The estimated crude deaths rate of 25-30 per 1000 of population per year in China, as compared with approximately 12 for such countries as England and U. S., shows the general need of public health. China thus has an *excess* mortality of 6 million preventable deaths per year, in comparison with which the famines and floods are relatively insignificant. Modern civilisation is so complex that for China to attain the desired position in the comity of nations, it is dependent upon the development of public health as well of industry, communication and education. We are sanguine enough to hope that our appeal for this substantial contribution to medical progress in China will meet with a favourable response by the Commission.

Among the hospitals and institutions which have been built under purely Chinese auspices may be mentioned the following :—

(*a*) Chinese Red Cross Hospital, Shanghai, founded over fifteen years ago by the late Mr. Shen Tun Ho, President of the Chinese Red Cross. It covers a big area of land and is managed by the two doctor brothers New, one a graduate of Cambridge, the other of Harvard. It has accommodation for over 200 and is a model of efficiency and economy. Here also is established a training school for nurses under the supervision of Miss Wu, a graduate of Johns Hopkins.

(*b*) Chinese Isolation Hospital, Shanghai, also managed by the News. The Chinese residents have more confidence in a hospital managed by their own doctors, and hence every summer when cholera, dysentery and other bowel diseases prevail, the wards are crowded with patients. The recoveries from Cholera (about 85 per cent.) in this hospital after saline treatment speak well for the skill of the doctors.

(*c*) Central Hospital, Peking, founded by Dr. Wu Lien Teh and designed after the latest American standards. The funds were contributed partly by government and partly by friends. It cost over $300,000 to build and equip, and was intended as a model for similar institutions in other Chinese cities. The accommodation is for 160 patients. Until Rockefeller erected the modern Peking Union Medical College, the Central Hospital was the finest institution of its kind in China.

(*d*) North Eastern Hospital, Mukden, completed in 1924 for Mukden city at a cost of $700,000. It has accommodation for 450 patients and is in the form of eighteen self-sufficient pavilions with covered archways leading from a central administration block. A railway platform and siding lead to the entrance of the hospital, so that in case of need wounded soldiers may be conveyed directly thither. This hospital has already rendered invaluable services during two campaigns.

(*e*) Two Cantonese hospitals, both built under modern auspices one in Shanghai (native city) and the other in Hankow. Here eastern and western methods of treatment are given.

(*f*) Health Demonstration Centers have also been established in important cities like Peking, Canton, Harbin, Nanking, where vital statistics on approved American models are being collected and studied.

It would be idle in a short article like this to list the number, increasing yearly, of hospitals and institutions established and financed by Chinese and run by their own doctors. The number of Chinese practi-

tioners of western medicine now numbers 12,000 including nurse-graduates distributed in the twenty odd provinces. Day by day, one sees an increasing desire on the part of the people to move with the times, and if the establishment of modern hospitals and medical schools has not appeared so significant as industrial and other money-making activities, the reason lies rather in the lack of well-trained doctors than in any want of desire to help on this humanitarian movement. So soon as the output of scientific and independent medical men and women is increased to conform with the growing needs of the country in this respect, the philanthropists of China will no doubt be found to do their share, the same as in America.

The following dates may serve as useful landmarks regarding the medical movement in China.

1805. Vaccination introduced into China.

1836. Dr. Peter Parker opened first hospital in Canton.

1846. Shantung Road Hospital, Shanghai, started by Dr. Lockhart.

1861. Dr. Lockhart started first missionary hospital, Peking.

1893. Peiyang Medical Hospital, Tientsin, established by Li Hung Chang.

1907. Army Medical College, Tientsin, established by Yuan Shih Kai.

1910. Pneumonic Plague invaded Manchuria from Siberia.

1912. Manchurian Plague Prevention Service established.

1914. National Medical Association founded.

1913. Post-mortems officially permitted.

1915. Western medicine officially recognised by Central Govt.

1917. Pneumonic Plague visited Shansi from Mongolia.

1918. Peking Central Hospital opened.

1919. Central Epidemic Bureau established in Peking.

1924. North Eastern Hospital, Mukden, opened.

1926. Appeal for Public Health needs laid before British Indemnity Commission.

WU LIEN TEH.

CHINESE MEDICAL SAYINGS AND PROVERBS.

I think it was Bacon who said that one can tell the education and spirit of a people by listening to its proverbs. The sayings and proverbs (P) of the Chinese are very numerous, and not a-few of them are related to medicine. These, however, are not easily accessible, being scattered among all kinds of literature. The following classified list is compiled from various sources; the origin, as far as possible, is given so as to facilitate reference. More interest will be derived from its use if one knows the time and locality from whence the proverb came for then the innermost thoughts and characteristics of the people of that age may be revealed. Omissions and inaccuracies are unavoidable. It is hoped that readers will point these out so that the proverbs may be corrected and their value enhanced.

No.	*Saying.*	*Reference.*
1.	The "superior man," if disinclined for official life, will practise medicine (for the doctor also can serve the people).	Chia I 賈誼
2.	A good doctor is equal to a good premier.	Lu Chi 陸贄
3.	If I cannot aspire to be a good statesman I will be a good doctor.	Fan Wen-ching 范文正
4.	One who serves one's parents should not be ignorant of medicine.	Cheng Yin-chuan 程伊川
5.	The doctor controls life and death.	Shih Chi 史記
6.	Only the healing art enables one to make a name for himself and at the same time give benefits to others.	Yuan Liao-fan 袁了凡
7.	Mathematicians, surveyors, fortune-tellers, physiognomists, physicians and magicians were charlatans. The sages did not regard them as educated.	Tang Annals 唐書
8.	Priests and doctors employed poisonous drugs to drive and expel disease, hence the ancients despised them and assigned them a low position in society.	Lu's Spring and Autumn 呂氏春秋
9.	Sun Szu-miao was a noted doctor of literature of the Tang dynasty. But as he took up medicine as a profession he was relegated to the class of artisan. What a pity!	Chu Hsi 朱熹
10.	Medicine is one of the nine low trades.	P.

11.	The doctor has the heart of parents.	P.
12.	A doctor has the heart to cut flesh off the thigh, but never the mind to deceive a patient.	P.
13.	When you are poor there is no clever man who will present you with money, but a doctor will give a prescription if you are ill.	P.
14.	Men worry over the great number of diseases, doctors worry over the small number of remedies.	Pien Chiao 扁鵲
15.	A teacher will not speak against a teacher nor a doctor against a doctor.	P.
16.	The sorcerer recites and chants for people and is benefited by their death; a doctor treats the people's sickness and is benefited by their living.	Chao Chi 趙岐
17.	A doctor's character should be square, his knowledge round, his gall bladder large and his heart small, (A large gall bladder signifies bravery, a small heart means carefulness).	Sun Szu-miao 孫思邈
18.	The good doctor first treats the disease of the nation, then human ailments.	Ancient History 史記
19.	The high grade doctor serves the nation; the middle grade doctor, the individual; and the low grade doctor treats physical ailments.	Thousand Gold Remedies 千金方
20.	A good doctor can tell the result of a disease.	Warring Nations 戰國策
21.	Do not take medicine compounded by a doctor who is not backed by the experience of three generations.	Record of Rites 禮記
22.	To become a good doctor requires breaking the arm three times.	Tso Chuan 左傳
23.	However well up one is in Wang Su-ho it is not so good as more clinical practice. (Practice makes perfect).	P.
24.	To be a caligraphist requires the wasting of paper; to be a doctor requires the sacrificing of lives.	Su Tung-po 蘇東坡
25.	Wide reading increases knowledge of diseases; more clinics give experience in diagnosis; repeated tests make properties of drugs better known.	Memoirs of Ch'u Shih 褚氏遺書
26.	The skilful doctor knows what is wrong by listening alone, the middling doctor by observation and the inferior doctor by feeling the pulse.	Thousand Gold Remedies 千金方

27.	Curved wood is found in abundance at the skilful carpenter's shop; crowds of patients are seen at the good doctor's office.	Shuo Wen 說苑
28.	Patients are not refused at the doors of Yu and Pien (two famous ancient physicians).	Liu Tsung-yuan 柳宗元
29.	The son of the good sorcerer is generally killed by demons; the son of the great doctor usually dies of disease.	Ancient Essay 古文
30.	Doctors cannot cure their own complaints.	Huai Nan-tzu 淮南子
31.	A doctor cannot cure himself (physician cure thyself).	P.
32.	The unlucky doctor treats the beginning of an illness; the fortunate doctor, the end.	P.
33.	A Huang Lu physician (a quack).	P.
34.	A quack has fish for breakfast and meat for dinner.	P.
35.	Quack doctors kill people.	P.
36.	To put one's life into the hands of a quack is to ask an ignoramus to correct an elegant essay.	Poems : Lu Yu 陸游詩
37.	The prescription is good but the medicine bad.	P.
38.	Quacks puncture and plaster, but only use spurious drugs.	P.
39.	Altering the prescription without changing the medicine.	P.
40.	Without perseverance one cannot even become a priest-doctor.	Analects 論語
41.	In the east of Kai-Min there lived sorcerers Pan, Ti, Yang, Li, Fan and Shang who were all skilful physicians.	Sea and Hill Classic 山海經
42.	Sorcerer Pang was the first doctor.	Shou Wen 說文
43.	Confucius was most careful with regard to worship, war and pestilence.	Analects 論語
44.	One who thinks too much of his victory will be ultimately defeated; one who abuses his health will easily get sick.	Bramble Garden Notes 荊園小語
45.	It is difficult to get old if one is seldom sick.	Kwan Tzu 管子
46.	Loss of taste for food indicates impending illness.	Yin Tzu 尹子
47.	The appearance of a disease is swift like an arrow; its disappearance, slow like a thread.	Ancient Saying 古語

48.	He who is pointed at by everybody will die without any visible illness.	Maxim.
49.	A disease often gets worse after having been a little better.	Biography of Han Shi 韓詩外傳
50.	When a disease reaches the region of the heart no medicine can effect a cure.	Tso Chuan 左傳
51.	No doctor however skilful can cure a fatal disease.	Huai Nan Tzu 淮南子
52.	A fatal disease cannot be cured.	P.
53.	When a disease relapses there is no cure.	P.
54.	There is no medicine for 'love sickness'.	P.
55.	Nine out of every ten men have piles.	P.
56.	Nine out of every ten women have 'Chi' (氣) air.	P.
57.	Out of ten persons eleven have the itch.	P.
58.	With a leper you may sleep in the same bed, but don't stay opposite the door of one who has the itch.	P.
59.	Rather marry a leprous wife than eat chicken reared by a leper.	P.
60.	A wife's leprosy does not pass over to her husband.	P.
61.	If a gambler can reform, then there too is medicine for leprosy.	P.
62.	Pockmarks are marks of beauty.	P.
63.	The more pockmarks one has the higher the honor.	P.
64.	Nine out of every ten persons with pockmarks are rich.	P.
65.	The doctor knits his brow if the patient suffers from cough.	P.
66.	When the thumb swells up to the size of the arm, or the arm swells up to the size of the thigh the disease is fatal.	Warring Nations 戰國策
67.	No medicine can cure a bladder distended above the navel.	P.
68.	Your father may be a doctor but he cannot cure you when you allow rain to run down your back.	P.
69.	Nine out of ten patients with dropsy are incurable.	P.

70.	Chills come from cold feet.	P.
71.	If your own tooth aches, then you know how to commiserate with one having a toothache.	P.
72.	Toothache is not a thing any one to inquire after no matter how it hurts.	P.
73.	Nothing under heaven or earth is more to be feared than a dam in the throat (sore throat).	P.
74.	If you wish your children to be well always let them be three parts (out of ten) hungry and cold.	P.
75.	If you love your children give them the cudgel; if you hate them cram them with dainties.	P.
76.	If a child is constantly sick it is due to overfeeding.	Chien Fu Essay 潛夫論
77.	It is the parent's fault if the child is not properly brought up.	Han Chang-li 韓昌黎
78.	A child is only born when he has gone through the ordeal of small-pox.	P.
79.	Think of the injury to their health when you give dainties to your children.	Lu Shen-wu 呂身吾
80.	Ten babies are born in ten different manners.	P.
81.	It is better to avert the malady by care than to use physic after it has appeared (Prevention is better than cure).	Poems: Shao Tzu 邵子詩
82.	The sage does not treat those who are ill but those who are well.	Su Wen 素問
83.	The good doctor pays constant attention to keeping people well so that there will be no sickness.	Huai Nan Tzu 淮南子
84.	The skilful doctor treats those who are well, but the inferior doctor treats those who are ill.	Difficult Classics 難經
85.	When you are well think of sickness and it will ensure health.	Family Treasure 傳家寶
86.	It is progressing when you know you are retrogressing; it is medicine when you realize you are ill.	Chen Hsien-chang 陳獻章
87.	When sickness comes then one realizes the joy of health, so it is better to prevent than to cure disease.	Chang Wu-chin 張無盡
88.	It is more difficult to get rid of a disease after it has appeared than to avoid it before it comes.	P.

89.	The superior doctor prevents sickness; the mediocre doctor attends to impending sickness, while the inferior doctor treats actual sickness.	Thousand Gold Remedies 千金方
90.	The able doctor acts before sickness comes.	Liu Kung-cho 柳公綽
91.	To take no medicine is the best treatment. (Let well enough alone).	P.
92.	It is a middling course to leave a disease untreated.	Annal of Art and Literature 藝文志
93.	Physical ailments require physic; mental afflictions need mental treatment.	P.
94.	The body may be healed but the mind is incurable.	P.
95.	When you treat a disease first treat the mind.	Maxims of Chen Jen 眞人語
96.	If a patient refuses to be treated do not prescribe for him for it would be ineffective.	Su Wen 素問
97.	In a dangerous illness call in three doctors.	P.
98.	If you must wait for Pien Chiao to treat you then you can never be cured.	Wen Ching-ming 文徵明
99.	It is easy to get one thousand prescriptions but difficult to get one effective remedy.	P.
100.	You can remove the trouble if you know the cause.	Mo Tzu 墨子
101.	The able doctor first attends to sleep and diet before prescribing drugs.	Wen Chung-tzu 文中子
102.	You cannot get effective treatment if you conceal your disease.	Hsi Lu Chih Chih 繁露執贄
103.	Do not conceal your symptoms to test a doctor's ability.	P.
104.	Feed a dysentery, starve a typhoid.	P.
105.	In typhoid don't treat the beginning, in consumption don't treat the end.	P.
106.	Cutting off the patient's head to cure hernia is the most wonderful remedy ever discovered. (The remedy is worse than the disease).	P.
107.	Prescriptions for eczema of the head are legion.	P.
108.	For colic get the bowels open.	P.
109	No money can buy a good purge during Fu Li (伏裏) festival.	P.
110.	To treat a dead horse as though it is still alive.	P.

111.	Mugwort three years old cannot cure a seven years' sickness.	Mencius 孟子
112.	Rather treat ten men than one woman.	P.
113.	If a medicine does not raise a commotion in the patient the disease will not be cured by it.	Shu Ching 書經
114.	If the medicine does not kill it cannot cure a disease. (Desperate disease requires desperate remedies).	P.
115.	Take medicine and add to the severity of the disease.	Chuang Tzu 莊子
116.	Though the medicine be bitter to the taste, it is good for the disease.	Confucius 孔子家語
117.	Medicine cannot cure an imaginary disease; wine cannot alleviate real sorrow.	P.
118.	No good doctor should enter a bad official's house; medicine should not be used to cure an unkind man's illness.	Ancient Saying 古諺
119.	Chi Kang having sent Confucius a present of physic, he bowed and received it saying "I do not know it. I dare not taste it."	Analects 論語
120.	The minister first tastes the medicine before giving it to the King; the son first tastes the medicine before giving it to his parents.	Chu Li 曲禮
121.	Cow's urine, horse excreta, and the skin of old drums are collected and used as medicine.	Nan Yu 韓愈
122.	A single unknown herb (used by the laymen) sometimes puts the scientific doctor into hysterics.	P.
123.	It is wrong to prohibit all doctoring simply because some one has died from taking drugs.	Kang Tsang Tzu 亢倉子
124.	Injury due to sickness may be removed but poisoning by drugs is difficult to remedy.	Ancient Saying 古語
125.	Drugs cure as well as hurt people.	Tseng Wen-ching 曾文正
126.	Do not take medicine if there is nothing wrong for it is only useful for curing disease.	Shen Chien 申鑒
127.	Good medicine cures, bad medicine kills.	Lu's Spring and Autumn 呂氏春秋
128.	The value of drugs does not depend on their price but on their effect; the value of prescriptions does not depend on their numbers but on their merit.	P.
129.	Though not a drug the spit is good for many ailments.	P.

130.	Death and life are decreed; riches and honours depend upon heaven.	Analects 論語
131.	When Yen Wang (the King of Hades) has decreed a man shall die at the third watch, no power can detain him till the fifth.	P.
132.	Still by a lotus fibre the big salt-junk is bound; and having reached their climax, diseases must turn round.	P.
133.	A physician can cure a man's sickness but cannot guarantee life.	P.
134.	No medicine can procure long life even to the ministers of state; no money can purchase for any man a virtuous posterity.	P.
135.	The best doctor cannot cure a fatal disease; the boldest robber cannot fight against heaven.	Su Ching-chuan 蘇竟傳
136.	Diseases enter by the mouth, troubles proceed from it.	Confucius 孔子
137.	A good appetite is a blessing.	P.
138.	Able to eat, able to work.	P.
139.	Drug tonics are not so good as nutritious food.	P.
140.	One's situation alters the air, just as the diet affects the constitution.	Mencius 孟子
141.	The hungry man is easily satisfied with food; the thirsty man is easily satisfied with drink.	Mencius 孟子
142.	Better have a bowl of congee and cheerfulness therewith than a dinner of rice and worry.	P.
143.	Worry not over other people's business and you can eat three bowls of rice.	P.
144.	Three meals a day with a good sleep at night is the Buddha of Longevity itself.	Ramble Notes 客座贅語
145.	Proper food and shelter make the whole system healthy.	Lu's Spring and Autumn 呂氏春秋
146.	Rice should be chewed into pulp before swallowing. It tastes better and is more nutritious.	Ho Yang-heng 賀陽亨
147.	Cleaning the mouth several times after every meal preserves the teeth.	Sun Szu-miao 孫思邈
148.	To court death by eating ho-tun (河豚) a kind of fish. (To sell your life for a mess of potage).	P.
149.	Assume anything unseen to be clean.	P.
150.	A dirty cook gives (the diarrhoea) quicker than rhubarb.	Tung Su-pai 董思白

151.	Rather swallow one hundred ants than the leg of one fly.	P.
152.	The effect of taking one leg of a fly is similar to a good dose of purgative.	P.
153.	Eat pumpkin today and tomorrow and the doctor will never come to your house. (An apple a day will keep the doctor away).	P.
154.	Don't eat meat or fish which is spoiled.	Analects 論語
155.	Don't eat things which are discoloured or of bad flavour.	Analects 論語
156.	Eat nothing that is improperly cooked or out of season.	Analects 論語
157.	Meat and wine bought from the street-stands must not be taken.	Analects 論語
158.	Hard is the case of him, who will stuff himself with food the whole day, without applying his mind to anything good.	Mencius 孟子
159.	There is nobody but eats and drinks. But there are few who can distinguish flavours.	Doctrine of the Mean 中庸
160.	The superior man does not in his food seek to gratify his appetite, nor in his dwelling place does he seek the appliances of ease.	Analects 論語
161.	If men are fed, warmly clad, and comfortably lodged, but without being taught at the same time, they become almost like the beasts.	Mencius 孟子
162.	All men unite in despising a glutton, because he gives up everything that is valuable for the sake of pampering what is so contemptible.	Mencius 孟子
162a.	Proper food and shelter make the nine apertures, the hundred joints and the thousand blood vessels healthy.	Lu's Spring and Autumn 呂氏春秋
163.	Rich food injures the stomach; lavish beauty drowns the conscience.	Essay on Iron and Salt 鹽鐵論
164.	Strong flavours injure the taste and destroy the appetite.	Huai Nan Tzu 淮南子
165.	One cannot live on meat and wine. These are called 'rot-your-bowels' food.	Lu's Spring and Autumn 呂氏春秋
166.	Rich foods are poisons.	Kuo Yu 國語
167.	One who wants health does not need meat.	Essay on Iron and Salt 鹽鐵論

168. Flesh eaters are stupid. They cannot see far.	Tso Chuan 左傳
169. Though there might be a large quantity of meat, one should not allow what one takes to exceed the due proportion for the rice.	Analects 論語
170. Fish generates fire, meat generates phlegm. Green vegetables and bean curd ensure health.	P.
171. Meat is the hull and rice the root (of health).	P.
172. Drink less wine, take more congee; consume more vegetables, eat less meat.	Much and Little Maxim 多少箴
173. Wine is a poison coursing through the heart.	Ancient Saying 古諺
174. Wine confuses the intellect.	Ancient Saying 古諺
175. There are innumerable diseases but the greatest inducer of them is wine.	P.
176. If you recognize the limits of eating and drinking, sickness will be less frequent.	P.
177. Ensure happiness and luck by contentment; promote health by keeping an easy stomach.	Su Tzu-tan 蘇子瞻
178. Do not induce impotency by improprieties of the bed chamber; do not injure your stomach by eating and drinking.	P.
179. Excessive clothing and over-feeding induce licentiousness.	P.
180. Regularity in habits and moderation in food give health and longevity.	Kwan Chung 管仲
181. Those who desire health should be temperate in eating and drinking.	Ko Hung 葛洪
182. Less eating, better taste; much eating, appetite destroyed.	P.
183. When you eat consult with your stomach.	Wen Chung-tze 文中子
184. Just take one mouthful less for supper and you will live to ninety and nine years old.	Ancient Drama 古樂府
185. Dainties when eaten often result in disease; pleasure when passed is certainly converted into pain.	The Heart Examiner 省心錄
186. The less you eat, the happier you feel, and the longer you live; the more you eat, the duller you feel, and the shorter you live.	The Science Record 博物志
187. If you want eternal life your bowels should be constantly clean; if you want immortality your bowels should be free of residue.	Lun Heng 論衡

188.	If a man is irregular in his sleep, intemperate in his eating, and immoderate in his work, sickness will kill him.	Confucius 孔子
189.	Immoderation in food causes sickness, immoderation in thought undermines the body.	Kao Chung-hsien 高忠憲
190.	To avoid sickness, eat less; to prolong life, worry less.	Chu Hui-weng 朱晦翁
191.	Sit quietly morning and evening and be always three-fourths full in your stomach.	P.
192.	Do not over-eat.	Analects 論語
193.	The best prescription for preventing sickness is; beware of over-eating.	Poem of Tang Tzu-wei 唐子畏詩
194.	Rice for breakfast, congee for supper will make the doctors weep.	P.
195.	Rice stalks for firewood, a lot of ashes; plenty to eat, a large stool.	P.
196.	An early breakfast, a full noon meal, but a light supper.	P.
197.	The way to make the body strong is to keep the house in proper repair, to select suitable beds and to be moderate in eating.	Lu's Spring and Autumn 呂氏春秋
198.	Prosperity, long life and happiness are certainly desired by everybody, but one cannot escape from sickness and death also.	Manual of Quotation 幼學
199.	To be free from sickness is to be as happy as a fairy.	P.
200.	The five blessings are long life, wealth, peace, love of virtue and a good end.	Shu Ching 書經
201.	Of the five blessings long life heads the list.	P.
202.	The two characters 'ping an' (平安) (peace or health) are worth a thousand in gold. (Health is wealth).	P.
203.	A poor man free from sickness is equal to a man twice as rich.	P.
204.	The thing that one dreads the most is sickness.	P.
205.	If you have not passed through the sufferings of severe sickness and pain, you do not know the blessings of being healthy and strong.	Family Treasure 傳家寶
206.	Careless when well, repentant when sick.	Family Treasure 傳家寶
207.	If the appetite and bowels are all right then you are well.	P.

208.	Do not fatigue your body nor exhaust your energy and you will live long.	Chuang Tzu 莊子
209.	Excessive use of energy induces exhaustion; excessive use of the body causes fatigue.	Su Ma-chien 司馬遷
210.	To nourish the heart there is nothing better than to make the desires few.	Mencius 孟子
211.	Few desires, spirits high; more worries, circulation poor.	P.
212.	Length of days grows out of peace and happiness; affliction grows out of inordinate lust.	P.
213.	Desires strong, more illness; spirit calm, circulation steady.	Sun Szu-miao 孫思邈
214.	There is nothing better than love of people if peace is desired; there is nothing better than less worry if health is wanted.	Wang Fu-su 王服素
215.	Worldly reputation and sensual pleasure are destructive to virtue; anxious thoughts and apprehensions are injurious to the body.	P.
216.	Worry and anxiety cause sickness and when sickness reaches the limit death follows.	Kwan Tzu 管子
217.	Sleeping alone will cure licentiousness; taking medicine will cure disease.	P.
218.	A gentleman sleeps in a separate bed (from his wife) a mediocre man sleeps under different covers.	Peng Keng 彭鏗
219.	Ten days drugging is not so good as one night's sleeping alone.	Chu Hui-weng 朱晦翁
220.	Sleeping alone is better than any medicine.	Peng-keng 彭鏗
221.	To conserve the energy is better than to search for medicine.	Maxim 格言
222.	Worry and grief induce sickness.	Huai Nan Tzu 淮南子
223.	Grief hinders the breathing, joy quickens the circulation.	Nei Ching 內經
224.	Pressed grass withers, an oppressed tree decays, when a man is oppressed disease arises.	Kang Tsang-tzu 亢倉子
225.	Contentment and peace shut out all worries giving no chance for evil to sneak into the system.	Chuang Tzu 莊子
226.	Every joint will feel good if the mind is peaceful.	Huai Nan Tzu 淮南子
227.	A troubled mind induces sickness, a peaceful mind dispels sickness.	New Remedies 療法新語

228.	A happy mind is medicine; there is no better prescription.	P.
229.	No medicine can be compared to the vigour of youth.	Strange Tales 述異記
230.	Before thirty men seek disease; after thirty diseases seek men.	P.
231.	The virtuous live long.	Analects 論語
232.	Riches adorn a house, virtue adorns the person. The mind is expanded and the body grows stout.	Great Learning 大學
233.	If health is desired avoid out-bursts of anger.	Tseng Wen-ching 曾文正
234.	Don't get angry under any circumstances.	P.
235.	Anger and worry result in sickness, happiness and cheerfulness make time fly.	P.
236.	A little regular work promotes health.	Bramble Garden Talks 荊園小語
237.	If the intellect is not exercised dullness follows; if the circulation is impeded sickness comes.	Lu Hsiang-shan 陸象山
238.	Prolonged inactiveness causes flabbiness of the muscles as well as weakness of the heart.	Wu Ling-yih 胡林翼
239.	Running water will not become stagnant; the used doorstep will not rot. The human body, if exercised, remains healthy.	Lu's Spring and Autumn 呂氏春秋
240.	Walk and exercise frequently are ways of promoting health.	Tseng Wen-ching 曾文正
241.	Exercise dispels the bad air, promotes the circulation of blood and prevents sickness.	Hua To 華佗
242.	After a meal walk 300 paces, and there will be no occasion to open an apothecary's shop.	P.
243.	To walk several thousand paces after every meal is one of the secrets of health.	Tseng Wen-ching 曾文正
244.	A daily walk will ensure lightness of body, clear vision and free circulation of the blood.	Pei Ch'u-kuan 備處貫
245.	Strength comes through work, sickness appears through idleness.	P.
246.	The mind should be calm and clear; the body should be strong and healthy.	Ta Mo 達摩
247.	Curb the appetite but avoid underfeeding.	Wei Feng-heng 魏封衡
248.	In order to develop the arms and hands they should be frequently stretched and flexed; in order to develop the thighs and legs take frequent walks.	Memoirs of Chu Shih 褚氏遺書

249.	The body should be moderately exercised but not overstrained.	Health Excerpts 保生要錄
250.	Deep breathing clears the intellect and prolongs life.	Huai Nan Tzu 淮南子
251.	By deep breathing the foul air is expelled and fresh air drawn in, thus promoting longevity.	Chwang Tzu 莊子
252.	During exhalation the dead air is expelled; during inhalation the fresh air is taken in.	Thousand Gold Remedies 千金方
253.	Do not expose the body after White Dew Festival.	P.
254.	One will become a good doctor if one has been sick long.	P
255.	Early rising has innumerable benefits.	Bramble Garden Talks 荆園小語
256.	If a strong body is desired rise early.	P.
257.	On the bathing-tub of Tang, the following words were engraved :—"If you can one day renovate yourself, do so from day to day. Yea, let there be daily renovation."	Great Learning 大學
258.	Be diligent in combing the hair and bathing the body. Avoid overcrowding, always sleep alone.	Much and Little Maxim 多少箴
259.	Before meals shave; after meals bathe.	P.
260.	Improper clothing is a curse.	Tso Chuan 左傳
261.	Before eating the Dragon Boat Festival dumpling don't put away your cotton garments, after this Festival there will still be three spells of cold weather.	P.
262.	Take off your garments if it is hot and put them on again if it is cold. This is better than taking drugs.	P.
263.	Don't be overheated in winter or over-cooled in summer.	Ko Hung 葛洪
264.	Do not talk in bed.	Analects 論語
265.	Have a night gown.	Analects 論語
266.	Do not sleep on your back.	Analects 論語
267.	Ten nights' sleep cannot make up one night's loss.	P.
268.	If you have no money to buy tonics try sleep.	P.
269.	The healthy man does not sleep in the day.	Lin Shu 靈樞

270.	The first secret of long life is to marry an ugly wife.	Ying Chu : Poems 應據詩
271.	The second secret of long life is not to cover the head during sleep.	Ying Chu : Poems 應據詩
272.	The third secret of long life is to abstain from tobacco and wine.	Ying Chu : Poems 應據詩
273.	A man should marry at thirty and a girl at twenty years of age.	Analects 論語
274.	If a person who does not know the parental duties has children education will be incomplete and premature deaths will be frequent.	Wang Chi-chuan 王吉傳
275.	Intermarriage of blood relations affects the off-spring.	Shih Pai 史伯
276.	When husband and wife are of the same surname the offspring are not numerous.	Shu Chuan 叔詹
277.	In ancient times the pregnant woman did not sleep on the side, or sit improperly, or stoop.	Biography of Famous Women 烈女傳
278.	Man does not die prematurely; the expectation of life depends on one's habits.	Essay on Iron and salt 鹽鐵論
279.	There are three things which are unfilial and to have no posterity is the greatest of them.	Mencius 孟子
280.	When the lips are lost the teeth get cold.	Tso Chuan 左傳
281.	Fellow patients sympathize with each other.	Chien Ko Lu Shu 潛確類書
282.	All covered with boils and sores i.e. a pitiable condition.	P.
283.	To give up eating for fear of being choked.	Ancient History 史記
284.	Gouge out flesh to fill up an ulcer with i.e. pay by borrowing.	Ancient History 史記
285.	The leprosy has appeared on the face i.e. no use to conceal it further.	P.
286.	To be born again and change the bones i.e. a radical change.	P.
287.	Arsenic soaked in honey i.e. the sweet words of a deceiver.	P.
288.	Unable to digest what is eaten i.e. to do things mechanically.	P.
289.	If you eat too much you cannot masticate thoroughly i.e. attempt too much.	P.
290.	A dumb man eating copte's teeta i.e. unable to say that it is bitter.	P.

291.	The mouth thirsty and still go and drink brine i.e. poverty increased.	P.
292.	The god of longevity takes arsenic; i.e. cannot be killed.	P.
293.	The ministers are the King's ears, limbs and eyes i.e. faithful servants.	Shu Ching 書經
294.	Though an open sore is painful it is better than gnawing pains internally, (such as unhappiness in mind).	Posterior Han Annals 後漢書
295.	To quench thirst by drinking poison.	P.
296.	Sickness and pain in one's embrace i.e. distressed in mind.	Shu Ching 書經
297.	Only a complaint of itch i.e. a trifling matter.	P.
298.	Pain and itching go together i.e. having relations.	P.
299.	The asthmatic can't bear coughing i.e. one can't endure the annoyance of other people's doings.	P.
300.	A river fish complaint i.e. diarrhoea.	P.

Translated by WANG CHI MIN, M.D.
(Hangchow).

A REPORT ON TWO CASES IN HARBIN.

(With one Illustration).

Reprinted from the National Med. Jl. of China, Vol. XI, No. 1, 1925.

TUBERCULOUS STRICTURE OF THE RECTUM.

A girl, 4 years of age, came to the hospital for treatment for difficulty of passing stools. The mother said that three months ago the trouble started. The girl could not pass stools and the stools were very thin and long. There were no pains, but for 2-3 days there were no motions of the bowel. She had no appetite and was getting thin.

On examination, the patient was somewhat pale, but fairly well nourished.

There were healed scars on the neck. In the left side of the back, some dullness could be elicited by percussion near to the vertebral column, indicating possibly bronchial gland involvement.

Per rectum, a stricture admitting only a probe was seen to be one inch above the anus. It was freely moveable, but its upper limit was difficult to determine.

On operation under C. E. anaesthesia, the stricture was slit up posteriorly, and an annular mass extending for 1 inch was discovered. This was freed from the surrounding tissue and resected. The healthy mucous membrane was brought down and stitched to the lower edges. A vaselined rubber tube was inserted for a few days.

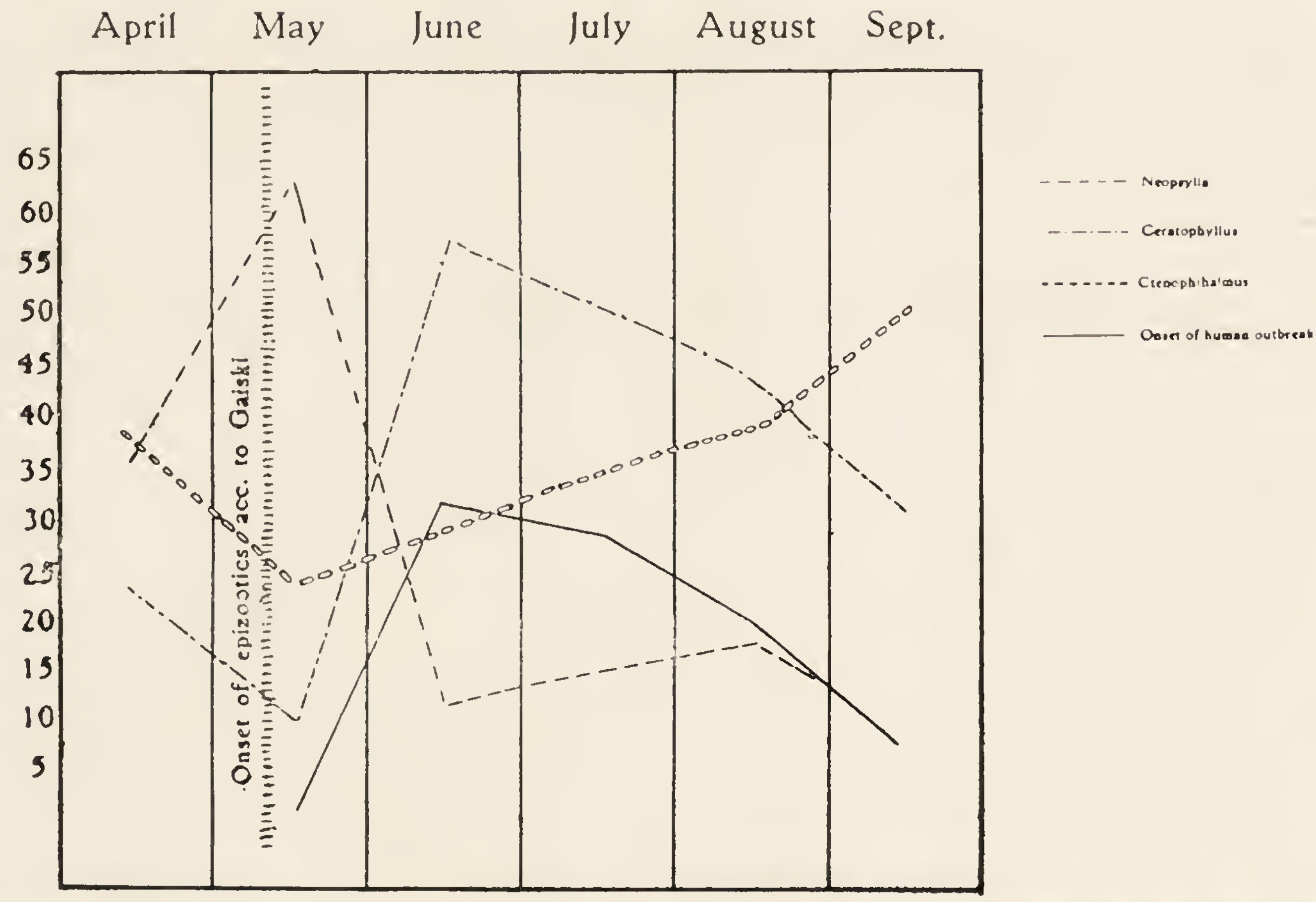
The child made a good recovery, though healing was slow and not by first intention. Normal stools were passed after operation and the patient gained weight.

A few sections were made from the mass and the pathologist reports that the mucous membrane of the rectum was cut vertically. Under the intact epithelium, small haemorrhages in the connective tissue and dilated vessels were observed.

The submucosa showed some round cell infiltration. Large strands of granulation tissue and cells of an epithelial character extended throughout the submucosa and parts of the muscular coat. In the submucosa, there were tubercles in all stages of development, some quite new, others already caseous, while regular giant systems were very numerous.

Stained by Ehrlich's method, isolated tubercle bacilli were seen in the periphery of caseating areas.

Diagram showing relation of flea rate in susliks and onset of human plague
(See page 48)



Fibrosarcoma of Ovary, cut in half, hingewise, showing the fibrous central part and cellular and vascular periphery.

卵巢纖維瘟腫横斷面圖

示纖維之中央部瘟細胞脉叢及其週圍等樣

FIBRO-CARCINOMA OF THE LEFT OVARY.

On 25th. Oct. 1924, a married woman age 49, 3 para, came to be treated for a tumour in the abdomen.

The history was that menopause came on for 3 years, but 6 months ago bleeding from the vagina occurred irregularly for one month and then stopped. Since this bleeding the abdomen gradually enlarged until now it is 45 inches in circumference. Meanwhile the patient gradually got thin, pale, and weak.

On examination, she was somewhat pale and thin, the abdomen was enormously distended, but there were no dilated veins. There was some free fluid in the abdomen.

A large hard solid tumour could be felt rising from the pelvis. This tumour was freely movable, and with 2 notches (spleen-like) on the upper part. There were 5-6 discret palpable glands in each axilla, none elsewhere.

Per vaginam, the fornices appeared to be filled up and the tumour seemed to be connected with the uterus.

The blood and urine were carefully examined, but nothing abnormal was found.

An exploratory operation was performed under chloroform, and a paramedial incision (10 inches) was made from the pelvis upwards. The tumour was found to be somewhat nodular, solid and attached to the left appendage of the uterus.

In fact it was an ovarian growth with a pedicle. The pedicle was clamped and cut. The ovarian vessels were tied and the stumps sewn up and buried.

The uterus and right ovary was examined and found normal. There were some enlarged lymphatic glands in the pelvis, however, but these were not touched. The patient recovered and the wound healed by first intention.

But the general condition of the patient was not satisfactory, even three weeks after operation. She developed a cough and an irregular temperature. The abdomen is again distended with some ascitic fluid and abdominal glands can be felt in the right groin. Instead of getting stronger, she is getting weaker and thinner daily. There is no doubt that metastasis is being deposited in the glands. The prognosis is very bad.

The pathologist reports that the tumour was solid with one small cyst in the centre. It was irregularly spherical and nodular on the surface. It weighed 10 lbs. On section the centre of the tumour was mostly glistening fibrous tissue, while near the periphery, cellular and vascular structures could be seen.

Under the microscope, the stroma of the tumour was formed by connective tissue in which clusters of epithelial cells were imbedded.

The cells were very often in long solid clusters. Sometimes they surrounded a blood vessel very closely, pressing parts of it into the lumen.

The cells were round in shape, with no intervening fibrous tissue, and showed very often severe mucous degeneration. They were large; stained deeply; their nuclei varying in size and form. Some of the swollen cells contained mucus or vacuoles. Very often one single vacuole fills up the whole cell, pressing the nucleus to the periphery (signet-ring forms). The nuclei showed frequently irregular karyokinesis.

In some parts of the tumour, necrosis of the tissue was seen, in others big areas of haemorrhages were very common.

Diagnosis :—Fibrocarcinoma with mucous degeneration.

This is apparently a case of primary carcinoma of the ovary which is rather rare according to Bland Sutton.

Generally the primary focus is elsewhere, in the mammary gland or stomach and secondary deposits are then found in the ovary.

J. W. H. CHUN, M.B., B.C. (CANTAB).

前面　　　　側面

示長骨之短小與四肢軀幹之不配合而手指肥胖短腿外彎著明

Case of Achondroplasia (a) Front view. Note the shortening of the long bones, resulting in a disproportion of the limbs to the trunk. The fingers are stumpy. Genu varus is well marked.

示軀幹與四肢長短比較之關係脊柱前曲之著明

(b) Side View. Note the relative length of the trunk as compared with the limbs. Lordosis is well seen.

Case of Achondroplasia.

骇斯光線照片

(*a*) X ray photograph of the hands. Note the short metacarpal and carpal bones. No epiphysial cartilage can be seen. Wrist bones are very small

示腕骨掌骨之短度軟骨缺如腕骨極細小

骇斯光線影片

(b) X ray photograph of both tibia and fibula. The epiphysial cartilage is absent, while the ends of the long bones are abnormally broad.

下腿脛腓二骨之形像軟骨缺如長骨之端異常寬闊

A CASE OF ACHONDROPLASIA.

(*With too photographs and two X-Ray pictures*).

A boy, by name Yen, 12 years of age, came under our attention, showing well marked signs of achondroplasia.

Family History. Father and mother were normal. There was no history of a similar disease in any of the relatives or ancestors. Five brothers of whom three died at infancy were well developed.

Past History. There was no difficulty at birth. Nothing abnormal was noticed until the fourth year of age when he failed to grow.

Description. Patient had normal and good features. His intellect was quite good and he was making progress at school. He was well nourished; the chest showed no abnormality. It was noticed, however, that his arms and legs were too short for his trunk. All the digits were stumpy and thick. The bones of the wrists were small so that he was "double-jointed," being able to bend the wrists far back. The legs were curved outwards, showing "bow-legged" appearance. The male sexual characters were not developed yet. There was also the usual lordosis. The thyroid gland was not enlarged nor were any of the lymphatic glands. The internal organs were all healthy.

Some measurements may be given as below :—

Height	90	cm.
Lower limb (Trochanter to heel)	37	cm.
Trochanter to knee	16½	cm.
Feet	14	cm.
Breadth	7½	cm.
Arms extended	86	cm.
Acromion to finger	37	cm.
,, ,, elbow	31	cm.
Hands	10	cm.
Breadth	8½	cm.
Pelvis	58	cm.

J. W. H. Chun,
Senior Medical Officer.

SCHEME OF SUPERANNUATION FUND FOR THE STAFF OF THE MANCHURIAN PLAGUE PREVENTION SERVICE.

(Approved by the Wai Chiao Pu)
Nov. 28, 1925.

A. The contributions of the *High Staff* of the Service are subject to the following stipulations:—

1.) A deduction of 10% from the monthly substantive pay shall be made at the end of the month—the deduction for any member however not to exceed silver $50.00

2.) The Service will on its part contribute from a small portion of the Service savings at the end of each month a sum equal to that deducted from the salary of the employee but also not in any case to exceed silver $50.00

3.) The money thus contributed and deducted will be deposited with a reliable bank on fixed deposit; the interest accruing thereon will be credited to the amount of each participant at the end of the fiscal year according to his share in the fund.

4.) A statement will be handed annually to each participant showing his contributions to date and what he has earned.

5.) No participant will be allowed to make any withdrawals from the fund as long as he remains in the Service.

6.) After three full years of service a participant who leaves is entitled to receive the whole sum accumulated under his name (vide 8).

7.) To those who withdraw (vide 5) before the expiry of three full years in the Service only the portion deducted from their salaries together with the interest accrued thereon shall be paid and they shall have no claim on the share contributed by the Service, which shall, together with the interest that has accrued thereon, revert to the Service (vide 9).

8.) The following are exceptions to (6):—

(a) dishonesty,

(b) neglect of duty,

(c) disobedience,

(d) misconduct,

(e) any cause that is contrary to honourable discharge,

(f) those who leave the Service without due notice.

In such cases a participant will not be entitled to the share contributed by the Service but shall receive back the deductions made from the salaries together with accrued interest, but should the Service have sustained any loss owing to dishonesty, malfeasance, criminal carelessness, etc., the amount of such loss shall be deducted.

9.) This article is to discriminate from Article 7 as follows :—

(a) In case of death or incapacitating sickness provided nothing detrimental to Service interests has been committed.

(b) Those who leave the Service on account of uncontrollable circumstances.

(c) Those incapacitated through overwork.

Under one of the above conditions although less than three years in the Service a participant will be allowed the money contributed by the Service (plus accrued interest thereon) in his favour. ...

10.) A special account shall be opened for handling all contributions, receipts and payments being recorded under a special procedure. The funds will be deposited in a reputable Bank as determined by the Director, shall lie in the Bank on fixed deposit, and at the end of each fiscal year the Accountant shall advise each participant what is due him in principal and interest (vide 3 & 4).

General :—

(a) Should there be a dispute over any point the decision of the Directors shall be final.

(b) In case of death of any member of the Service, all the amounts due to him are paid to the relations of the deceased after deduction of funeral expenses together with any debts to the Service.

(c) In case there are no claimants for the contributions of the deceased, the Service will find and inform the relatives of the deceased requesting them to come within a year's time for obtaining under guarantee the money, which if unclaimed after expiry of the time limit is to be attributed to the Service fund after the deduction of the funeral expenses incurred.

B. *Members of the Lower Staff* are entitled to the following benefits :—

1.) On the completion of each full year's service the Service will contribute one month's pay as superannuation money and interest will accrue thereon in the same manner as on the contributions of the Higher Staff.

2.) This sum shall be considered purely as a contribution on the part of the Service and is subject to the same regulations in the matter of withdrawal from the Service by the employee as the contributions of the Service to the Higher Staff.

3.) In the case of death of a Lower Employee while in Service an additional issue will be made to his estate of two months' post mortem pay.

NORTH MANCHURIAN PLAGUE PREVENTION SERVICE.

SUMMARY OF TWELFTH ANNUAL GENERAL REPORT 1924.

Harbin, 31st October, 1924

To

His Excellency,

The Ministry for Foreign Affairs,

Peking.

Sir,

I have the honour to submit a summary of the Twelfth Annual General Report of the North Manchurian Plague Service for the year ending September, 1924.

2. It may be at once stated that during these past 12 months, the plague situation throughout the world was serious.

In India, plague was very prevalent, for between October 1923 and May 1924, 238,000 cases were reported, resulting in 180,000 deaths. The most severely affected district was the Madras Presidency.

In 1923 there was a general increase of plague in the well-known and principal foci throughout the world, in the Kirghiz and Kalmuck regions in Russia, in British India, in the Straits Settlements, in Egypt, Siam, Mesopotamia, Persia, Africa, Madagascar, and South America. Moreover, there does not seem to be any improvement in the situation in 1924.

Coming nearer home, Hongkong appeared to be but little affected, while Japan, Foochow, Amoy, Antung and Nanking reported some cases.

North Manchuria has been free from plague, though two cases were reported from Substation 83 near Dauria (East Siberia) in August 1924, and one case from Haranor village in September 1924, both places being in Soviet territory, 30-50 miles west of the Manchurian frontier.

In Chita, in December 1923, two laboratory workers of the Veterinary Institute—a lady doctor and a male assistant—died of pneumonic plague. The lady doctor accidently spilled an emulsion of plague culture on her apron, became ill 5½ days afterwards and died 4 days later. The male assistant was infected by her when he went to visit her.

The constant menace of Manchuria by plague is from Transbaikalia. There is an enormous territory involving practically the whole of Central Asia, from the Khingan Mountains in Manchuria to the Ural Provinces in Asiatic Russia where a rodent, the marmot (or tarabagan) abounds. The animal yields a good fur, its flesh is eaten and its fat is utilised, so much so that it almost stands for money to the natives and is eagerly hunted. We have proved conclusively by long and painstaking investigations that the tarabagan harbours the plague bacillus and acts as a reservoir for it. In fact, it is infected by a chronic form of plague, which may change into an acute one, resulting sometimes in an epidemic of plague among the tarabagans.

If a man were to skin a plague stricken tarabagan, he may be infected through wounds on his hands. Our latest research showed that the fleas of the tarabagan can transmit plague from one animal to another and this mode of infection has also to be considered. In whichever way man is infected, he suffers from bubonic plague. As a result, secondary plague pneumonia may set in and he may in turn infect his room-mates through the breath by coughing and sneezing. Such contacts will now suffer from primary plague pneumonia and spread the disease to others.

This then is the way an epidemic of pneumonic plague starts in this part of the world, and given other favourable conditions, such as overcrowding and rapid transportation, the disease will spread like fire. The plague problem is essentially a tarabagan problem and it is our constant endeavour to solve it by research.

3. *Other infectious diseases.*

North Manchuria may be said to be free from any serious epidemics during the period under review.

Cholera did not make its appearance though there were a few cases reported from Shanghai, Wuchang, and Dairen. During the hot weather large numbers of enteritis, typhoid and dysentery cases were seen. Several cases of encephalitis lethargica were discovered in Dairen, Port Arthur, Seoul and Changchun, and doubtless there were sporadic cases in North Manchuria as well.

This disease is often confused in the lay press with sleeping sickness (Trypanosomiasis), a sickness conveyed by the bite of the tsetse fly in Africa. There is no doubt that encephalitis lethargica is infectious and that it is increasing, for 4,000 cases were reported in Japan up to 5th. September 1924. In England, 2475 cases have been notified between 1st January and 17th May, the chief centres affected being London, Manchester, Sheffield, Birmingham and Bristol.

Malaria is comparatively rare locally, though it is prevalent in the Amur river ports. Formerly it was not prevalent in Siberia, but now it is widely spread. Similarly the Ussuri District was fairly free from

Malaria, but with the introduction of rice cultivation and the close contact with the Koreans many of whom are malarial subjects in the valley of the river Mo, a great increase in the number of Malaria cases is the result.

4. Our New Laboratory, measuring 105 ft. by 32 ft., is completed this October, and connected directly with the main office building. We have now a well fitted-up place in which important research work on plague and other disease problems may be carried out. In this respect we are fortunate in enlisting the services of Drs. Pollitzer, Jettmar and Lin who are well trained and experienced workers.

In this new building, there are rooms for plague work, serological work, chemical analysis, clinical diagnosis, preparation of media, and for library and museum.

I beg to send a few photos of the building with this report.

5. The Antung Quarantine Hospital, built with an appropriation of Tls. 30,000 from the Customs, was established this summer. Dr. W. H. Shih, Medical Officer stationed in Taheiho, was appointed to take charge of the hospital in August.

The Antung Quarantine hospital, affiliated to the North Manchurian Plague Prevention Service, is a much felt want and is a great asset to the port. There are but few ports namely, Shanghai, Foochow, Tientsin, Tsingtao, Newchwang, and Dairen on the China coast which can boast of quarantine hospitals, though Port Health Officers are appointed in all ports.

Now if a case of infectious disease is discovered on board a ship in port, and if the port does not possess a quarantine hospital, an awkward and maybe dangerous situation at once arises.

Each of the more important ports of China should have a quarantine hospital staffed by one or more full-time medical officers. The Newchwang Quarantine Hospital may be taken as a model with modifications to suit local conditions. In the absence of epidemics, part of the hospital may be used for general medical and surgical cases. Health propaganda work should also be undertaken.

All the hospitals should be controlled from a central port and reports of infectious diseases should be exchanged and made known to all ports in order to secure co-operation.

6. The following are figures showing the number of out-patients treated at the different station hospitals for each year during the last five years :—

	1923-24	*1922-23*	*1921-22*	*1920-21*	*1919-20*
Harbin	15,661	15,343	9,345	5,058	11,468
Taheiho	7,327	8,037	4,290	4,649	6,585
Sansing	4,379	5,235	4,054	3,631	4,694
Lahasusu	1,569	1,470	2,213	3,229	1,885
Newchwang ...	4,100	3,693	3,043	2,225	3,230
Manchouli ...	2,214	2,347	2,291	—	—

7. The following comprise the personnel of the Service during the past year :—

Dr. Wu Lien Teh, Director & C.M.O. (on 1 year's leave to America).

Dr. J. W. H. Chun, Actg. Director & C.M.O. (from July, 1924).

Mr. R. G. L. d'Anjou, (Comm. of Customs), Lay Director and Treasurer, (up to April 1924).

Mr. U. Marconi, (Actg. Comm. of Customs), Lay Director and Treasurer, (from May 1924).

Dr. R. Pollitzer, Bacteriologist, Harbin.

Dr. Lin Chia Swee, Resident Senior Medical Officer, Harbin.

Dr. H. Jettmar, Serologist, Harbin.

Dr. E. B. Young, Resident Senior Medical Officer, Newchwang.

Dr. Shih Chi Liang, Resident Medical Officer, Taheiho.

Dr. Y. M. Kwan, Resident Medical Officer, Sansing.

Dr. Li An, Resident Medical Officer, Manchouli.

Dr. Shih Wei Hua, Resident Medical Officer, Antung.

Dr. Chow Soo Bin, Asst. Resident Medical Officer, Harbin.

Mr. Tung Lan Chi, Resident Dresser-in-charge, Lahasusu.

Mrs. Y. C. Y. Cheh, Deputy Female Medical Officer, Taheiho.

Miss N. C. Chung, Senior Nurse, Harbin.

Miss Chu Tsai Chen, Senior Nurse, Newchwang.

8. In conclusion, I take this opportunity to express thanks to the Government, Chinese Eastern Railway and South Manchurian Railway for facilities granted us in the prosecution of our work. We are also indebted to the Customs officers at various stations in Manchuria for frequent assistance rendered to the Service. Finally I beg to remark on the faithful and unfailing devotion to duty shown by members of our staff.

I have, etc.,

(*Signed*) J. W. H. Chun,

Acting Director and Chief Medical Officer.

NORTH MANCHURIAN PLAGUE PREVENTION SERVICE.

SUMMARY OF THIRTEENTH ANNUAL GENERAL REPORT, 1925.

Harbin, 6th November, 1925.

To
His Excellency,
The Minister For Foreign Affairs,
Peking.

Sir,

I have the honour to submit a summary of the Thirteenth Annual General Report of the North Manchurian Plague Prevention Service for the year ending September 1925. Owing to my having stayed in Japan for the meeting of the Far Eastern Association of Tropical Medicine during the month of October, a short account of its proceedings may with advantage be included here.

2. Plague. This disease is still widely disseminated throughout the world, some places showing an increase, and others a decrease this year as compared with preceding ones. Thus :—

Country.	1922		1923		1924	
	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.
Egypt	487	228	1519	725	377	194
Madagascar	125	28	698	479	1661	1354
Senegal	874	490	1221	846	1831	1071
Uganda	1362	1305	838	914	616	534
Br. South Africa	10	8	20	12	400	246
Peru	801	369	855	393	274	108
U.S.A. (Los Angeles)	0	0	0	0	40	34
Dutch Indies	—	10967	—	8675	—	13060
Hongkong	1181	1071	148	136	0	0
Br. India	—	86847	—	239481	—	377854
Fr. Indo-China	1268	1093	1040	844	766	453
Iraq	686	—	708	413	529	308
Japan	118	89	1	1	7	6
Siam	135	110	399	329	95	67

It is interesting to note that no cases of Plague have been recorded in Hongkong since September 1923, and this offers a fine opportunity for those in authority to be fully rid of the pest by systematic rat-proofing of houses.

3. The plague situation in Manchuria is satisfactory, for no cases have been found anywhere, except two among the Russian colonists on May 29th, at Hahonteh, a small station between Hailar and Manchouli on the Chinese Eastern Railway. Here two Russians who had been hunting tarabagans developed bubonic plague, one with pneumonic complications. The latter died.

An unexpected group of four cases of Bubonic Plague occurred among Chinese in Shanghai between Oct. 27 and Nov. 15, apparently arising from some rats which had hidden in the straw of a crockery establishment. These cases may be summarised as follows :—

No. Age.	Date Reported.	Locality.	Result.
1 m. ?	Oct. 27.	Internat. Sett.	Recovered.
2 m. 27	Nov. 6.	,, ,,	Died Nov. 9.
3 m. 18	Nov. 2.	,, ,,	Recovered.
4 m. 19	Nov. 15.	,, ,,	Died Nov. 18.

Cases 1-3 lived in the same locality (Shantung Road), where three infected rats were found about the same time.

A rather serious epidemic was reported from Hsing-hsien District in North Shansi Province, about 35 miles from Paotehchow (保德州 where the 1917-8 epidemic of Pneumonic Plague started. Chinese medical officers sent to the spot reported 20 out of 27 villages to be affected with a total of 790 deaths, practically all bubonic. The epidemic covered the month of October, 1924.

In Transbaikalia, a few sporadic cases occurred, namely, 3 Pneumonic (fatal) at Turga (between Chita and Borzia) on Oct. 25, 1924; one bubonic (fatal) at Sharasun (on the Manchouli frontier) on May 19, 1925; one bubonic (fatal) at Birka (between Turga and Onon on the Chita Railway) on Aug. 8, 1925. One interesting laboratory infection was reported from Urda in South Russia, where Dr. Mikailoff developed Pneumonic Plague while working upon mice. He fell sick on May 22 and died on May 29, 1925. His wife showed similar symptoms on May 31 and expired on June 3.

4. *Cholera.* This has occurred in epidemic form during this summer, appearing first at Shanghai early in July and reaching its climax in August. Although the number of cases recorded officially were a few hundreds only, there must have been a few thousands with a death

rate of 10 to 14 per cent. At the Chinese Isolation Hospital, 664 cases were admitted up to August 14th, of which 400 were Cholera, with 45 deaths. The epidemic travelled to Nanking, Ningpo and other neighboring cities, and three carriers were found on board steamers bound for Dairen, but fortunately these were detected in time. The Philippines and several cities in Japan were invaded, but the outbreak was limited at these places. Thanks to early precautions taken, Manchuria escaped. Our Quarantine Hospital at Newchwang detained one shipload of 53 coolies on Aug. 30-Sept. 4.

I happened to be in Shanghai during August and took the opportunity to have some samples of water from the intake (Soochow Creek) and mains of the Chapei Waterworks examined bacteriologically at the Municipal Laboratory. The findings were that cholera vibrios were present in the samples of Soochow Creek water supplied, but none in the filtered water.

The constant threat of cholera invasions from epidemic centers like Shanghai places a great responsibility upon health authorities, and it is hoped that more effective co-operation may be obtained by earlier notification and enforcement of preventive measures without unnecessary red tape or selfish considerations.

5. *Other infectious diseases.* Among other infectious diseases, small-pox has been quite prevalent in North Manchuria, particularly Dairen, Changchun, Mukden and Harbin, a large number of the cases occurring in May.

Scarlet Fever, Diphtheria, Influenza, Typhus and even Malaria were more frequently encountered this year than in the last. Altogether this has been an unusually bad year for most communicable diseases.

6. I obtained a year's leave from July 15, 1924, and spent it mainly at the Johns Hopkins School of Hygiene, taking the regular course of the D.P.H., which I obtained in June 1925. I had also opportunities to lecture on Plague and various aspects of Public Health in China as well as to devote three months to special work at the Hygienic Laboratory of Washington, Surgeon General's Library (Washington), Quarantine Stations at Staten and Ellis Islands (New York), New York State Health Department (Albany), Yale, Philadelphia, Detroit and Chicago. Each of these health centers has its peculiar problems to solve, and it was a great privilege for me to personally meet and talk with the eminent public health workers of America, who have been able within the short space of twenty years to transform their huge country into perhaps the most up-to-date health center in the world.

I returned to Harbin on June 28th *via* Japan and Chosen.

7. That practical co-operation in international health work in the Far East, as well as in Europe, is making rapid strides is shown by the establishment at Singapore of the Far Eastern Bureau of the League of Nations, Health Section, with Dr. Gilbert E. Brooke as the first Director. An International Conference was convened at Singapore from Feb. 4

to 13, 1925, and attended by delegates from British India, Br. North Borneo, Ceylon, China, Federated Malay States, French Indo-China, Hongkong, Japan, Netherlands East Indies, Philippines, Siam, Straits Settlements, and League of Nations. Important matters were settled including the publication of a weekly Epidemiological Intelligence Report containing telegraphic summaries from eastern maritime stations. The first fasciculus was dated March 14. Our Plague Prevention Service is co-operating with this Bureau and receiving a weekly telegraphic report from Singapore. All countries are thus prepared for emergencies.

Four important members of the League of Nations inspected our hospitals at Manchouli and Harbin recently. These were Drs. Barykin and Casaneuve (who stayed in Harbin from Oct. 9 to 12) and Drs. Rajchman (Director of the Health Section Geneva) and Kusama (representative of Japan) who spent three hours at our Harbin Laboratory on November 2nd. These and delegates from other countries are visiting the health centers of Japan in October-November under the auspices of the League of Nations, and will probably reach Peking on December 5th, when it is hoped they may be shown some of our work in China.

8. The Far Eastern Association of Tropical Medicine held its sixth Biennial Conference in Tokio from October 11 to 21. At least twenty five delegates from China attended—the largest from any one country—and were received everywhere by their Japanese hosts with the greatest cordiality. The total number of members attending was over 400, including 80 from foreign countries. The papers read reached 267, and may be divided thus :— Medicine (56), Pathology (49), Parasitology (34), Public Health and Hygiene (32), Bacteriology (30), Physiology (31), Surgery (18), and Pharmacology (17). Of these, over thirty were from the delegates of China. Our Service was represented by myself and Dr. Lin Chia Swee and contributed four papers, namely :

a. The Scarlet Fever Problem in the Far East.
b. Beri-Beri Control from an Administration Standpoint.
c. Practical Aspects of Plague in Wild Rodents.
d. Public Health Aspects of the Narcotic Problem.

Two important administrative matters relating to Beri-Beri and Maritime Quarantine were also passed, the first urging respective governments to include Beri-Beri as a preventable disease and to pay more attention to inspection of rice production, the second stressing the need of a simpler and more suitable Convention in the Far East than the Paris one and revising the present regulations for plague so that they should be based, except for the pneumonic form, on the principle of rat and flea, and not man, transmission of the disease.

Besides Tokio, the delegates and their families were entertained at Nikko, Hakone, Kioto, Nara, Osaka and Kobe, our Hosts ranging from the Imperial family and Prime Minister Kato to the chambers of Commerce and private citizens. Those three weeks in Japan were certainly very full ones from all points of view.

The next Conference will take place in Calcutta in 1927, and it is hoped that the one after that (1929) will be in Peking.

9. Thanks to our persistent advocacy of a scientific control rather than mere prohibition of the trade in tarabagan skins for the last three years, the Governor of Heilungkiang has now rescinded the restrictions upon tarabagan hunting, and since September 1st, 1925, the trade has been allowed under proper supervision. Certain regulations have been drawn up by the local Taoyin, while our Service has published an illustrated booklet written in plain mandarin for the guidance of hunters and dealers. Disinfection stations for the proper storage and disinfection of skins have also been established at Manchouli and Hailar under the care of our medical officers. In this connection it may be interesting to know the Police Department of Hailar has appropriated the necessary funds for the establishment and maintenance of a modern hospital in that city and affiliated it to our Service. Our chain of anti-plague hospitals in Manchuria is now almost complete.

10. The several hospitals under our control report continuous progress, but everywhere we emphasise more the preventive rather than the curative side of our work. In such a comparatively new territory as Manchuria, where the inhabitants are mostly immigrants from the south, it is necessary for them to witness also the advantages of modern curative medicine in order to have faith in modern methods of public health.

The following figures show the number of outpatients treated at various station hospitals during the last five years :—

	1924-25.	*1923-24.*	*1922-23.*	*1921-22.*	*1920-21.*
Harbin	22,874	15,661	15,343	9,345	5,058
Taheiho	4,669	7,327	8,037	4,290	4,649
Sansing	4,603	4,379	5,235	4,054	3,631
Lahasusu	1,629	1,569	1,470	2,213	3,229
Newchwang	4,675	4,100	3,693	3,043	3,225
Manchouli	3,234	2,214	2,347	2,291	—

Harbin reported 309 medical and 476 surgical inpatients during the year, the former including some cases of tertian and tropical malaria. We also conducted a series of 1275 Dick tests upon the Chinese of Harbin for Scarlatina during the summer, and found positive reactions in 47.7% cases. Similar tests upon 542 school children showed as high as 86% positives. We are now preparing anti-scarlet fever serum for this fatal disease of North China, and hope it will be available for distribution at the end of the year.

11. The personnel of the Service for 1924-5 are as follows :—

Dr. Wu Lien Teh, Director and Chief Medical Officer.

Dr. J. W. H. Chun, Senior Medical Officer, Harbin.

Mr. U. Marconi, (Commissioner of Customs) Lay Director and Treasurer.

Dr. Lin Chia Swee, Senior Res. Medical Officer, Harbin.

Dr. R. Pollitzer, Bacteriologist, Harbin.

Dr. H. Jettmar, Serologist, Harbin.

Dr. E. B. Young, Senior Resident Medical Officer, Newchwang.

Dr. Shih Chi Liang, Resident Medical Officer, Taheiho.

Dr. Y. M. Kwan, Resident Medical Officer, Lahasusu.

Dr. Li An, Resident Medical Officer, Manchouli.

Dr. Shih Wei Hua, Resident Medical Officer, Antung.

Dr. Chow Soo Bin, Assistant Medical Officer, Harbin.

Dr. Li En Chang, Resident Medical Officer, Sansing.

Dr. Liu Hsing Chi, Resident Medical Officer, Hailar.

Miss Liu Chi Chieh, Dep. Female Medical Officer, Taheiho.

Miss N. C. Chung, Senior Nurse, Harbin.

Miss Liu Tzu Ming, Senior Nurse, Newchwang.

12. In conclusion, I wish to take this opportunity of expressing my thanks to various departments of the Chinese Government, to the Chinese Eastern Railway and the South Manchurian Railway for facilities granted to us in the prosecution of our work. As in former years, the Soviet Government has offered us frequent facilities for our investigations. We are also indebted to the Customs Officers throughout Manchuria for assistance rendered to our Service. Finally, I beg to record the faithful and unfailing devotion to duty shown by members of our staff.

I have, etc.,

(*Signed*) WU LIEN TEH.

Director and Chief Medical Officer.

NORTH MANCHURIAN PLAGUE PREVENTION SERVICE.

SUMMARY OF FOURTEENTH ANNUAL GENERAL REPORT, 1926.

Harbin, 20th October, 1926.

To

His Excellency,

The Minister for Foreign Affairs,

Peking,

Sir,

I have the honour to submit a summary of the Fourteenth Annual General Report of the North Manchurian Plague Prevention Service for the year ending September 1926.

2. *Plague.* The plague situation in the world is fairly satisfactory, although the incidence in India during the past year has been high. A few sporadic cases among Russians were recorded from the endemic Transbaikal region as follows:

Date.	*Locality.*	*No. cases.*	*Result.*	*Remarks.*
Aug. 25	Haranor	2	Fatal	No details.
Sept. 5	Near Manchouli	1	Fatal	Hunted in Mongolia.
Sept. 10	Borzia	2	One fatal	5 contacts well.
Sept. 19	Olovianaya	2	Fatal	22 contacts well.

All the bubonic cases were in persons who had hunted tarabagans while the two pneumonic ones occurred among horse-breeders at Olovianaya, an important city lying midway between Manchouli and Chita. It is probable that these are not the original cases but have developed secondarily from previous bubonic ones in an endemic centre.

Yokohama in Japan reported 9 bubonic cases (7 fatal). Bangkok, Saigon, Singapore, Rangoon and Batavia also had cases in the summer.

3. *Cholera.* This has been a bad year for cholera throughout the East. During the spring months it spread all over Indo-China and many thousand cases occurred in India. Siam alone recorded 2,000 deaths. In China the first cases appeared about the middle of May in the Chapei District of Shanghai, but the first official declaration was made by the Health Office of the International Settlement on June 8 in a patient admitted four days previously. From that date onwards the infections began to accumulate until the summit was reached about the week Aug. 1-8, during which 2481 patients were treated at the two Chinese Summer Diseases Hospitals. Altogether no less than 20,000 cases have occurred in the Shanghai District alone. Severe outbreaks

were also reported in almost every city in the Yangtze Valley as well as centers further south, such as Foochow, Amoy, Swatow, Canton, Hainan, etc. The epidemic also invaded Japan and Korea.

It may be remembered that last year at my request samples of water from the Chapei Water-works were bacteriologically examined by the Health Office of Shanghai Municipality for cholera organisms. The report was that although pathogenic vibrios were found in a sample from the Soochow Creek, none was obtainable from the tap water. This year the same authority announced the discovery of virulent organisms in all samples of water taken from the intake (Soochow Creek), effluent from the filter-beds and a tap from the mains. Much acrimonious controversy in the local newspapers has resulted as a consequence.

It seems to me that the final goal can only be attained if a Cholera Prevention Conference on broad humanitarian lines is convoked to discuss among other things :—

a. The epidemiology of Cholera in China, including an intensive study of suspected sources throughout the year, e.g. water, human carriers, flies, food etc.

b. The need of commencing early preventive measures in the spring, including mass prophylactic inoculations.

c. Early notification to non-endemic centres with a view to limiting its spread to other localities.

d. Efficacy or not of mass fecal examination at ports, railway centers, etc.

Where the prosperity and welfare of the Chinese and foreign Communities are so closely intertwined as at Shanghai and other treaty ports, it seems obvious to every non-prejudiced person that the closest cooperation in all health matters is essential if this yearly occurring epidemic is to be effectively stamped out.

4. Regarding the northern area the first case was recorded on August 5 in Harbin whither some carriers probably conveyed the infection. The following table of occurrences in this connection is illuminating :—

Locality.	Quarantine declared against Shanghai.	First cholera case.		Quarantine stopped.
Dairen	July 22	Aug. 28		Oct. 11
Antung	July 29	Sept. 7		---
Newchwang	July 19	Aug. 19		Oct. 10
Tsingtao	Aug. 9	Aug. 6		Oct. 15
Japan	Aug. 2	Aug. 3	(SS. Macedonia)	—
Tientsin	—	June 15		—
Harbin	—	Aug. 5		Sept. 15
Port Arthur	July 22	Aug. 27		Sept. 24
Changchun	—	Aug. 14		Sept. 18

From it we gather that :

a. Quarantine measures were in most cases applied too late,

b. Even with this delay the first cases in each centre appeared after a considerable interval,

c. Outbreaks when they did occur were of comparatively short duration, the end coinciding often with the coming of cool weather.

The whole 1926 cholera epidemic claimed only 1,500 victims in Manchuria as compared with 10,000 in 1919; this is specially marked in Harbin which had 4500 cases in 1919 but only 280 in 1926. This satisfactory state of affairs may be traced to :—

a. Early preventive measures by the medical authorities,
b. Good understanding between the civil and medical administrations,
c. Hearty co-operation between the Chinese and Japanese health personnel,
d. Effective educational propaganda among the masses who willingly receive prophylactic inoculations and send their patients early to hospital for treatment,
e. Possibly prevailing wet weather during the second half of summer.

The policy of co-operation in fighting a dangerous epidemic where more than one nationality exercise power in a district, may be profitably followed in other parts of China.

5. In Harbin three hospitals were organised for the treatment of cholera cases with the following results :

	No. of sick.			*No. of deaths.*			*Total %*
Hospital.	*Chin.*	*Russ.*	*Tot.*	*Chin.*	*Russ.*	*Tot.*	*deaths*
Pinchiang	168	0	168	29	0	29	17.3
Railway	32	23	55	9	10	19	34.5
Municipal	26	40	66	13	23	36	54.5

It will thus be seen that our Pinchiang Hospital managed to save twice as many patients as the Railway and more than three times as many as the Municipal Hospital.

Besides hospitalisation the authorities adopted mass prophylactic inoculation with vaccines manufactured in our Harbin Laboratory and the Dairen Hygienic Institute. Dr. Kanai, Head of the South Manchurian Railway Health Office, informs me that the Chinese who came this year for prophylactic treatment, were three times as many as the Japanese—an advance indeed on conditions three years ago when they fought the Japanese Police during the latter's attempt to enforce vaccination.

6. *Other infectious diseases.* Both smallpox and scarlet fever were unusually prevalent last winter, but we hope that with the increase of knowledge and a better understanding of health matters among the masses, such as is evidenced during plague and cholera outbreaks, considerable improvement will take place in future years. Our laboratory has prepared considerable quantities of toxin and anti-toxin for scarlet fever. During the coming year we shall perform systematic immunisations

against this dangerous infection upon the ten thousand odd school children in the Harbin District. Our Laboratory is supplying the diluted toxin for Dick tests at a nominal price of one cent per dose.

Other communicable diseases, like diphtheria. typhus, dysentery, etc., do not seem to be above normal. Towards the end of September a mild form of influenza seemed to attack a considerable portion of the inhabitants.

7. *Health Survey of Pinchiang.* In accordance with the modern trend of public health development, our staff undertook from January 1, 1926, a survey of public health conditions in Pinchiang (Chinese city of Harbin) with a view to improving the health of the residents wherever possible. The results were announced at the meeting of the China Medical Association last September and will be included in Vol. V of our Service Reports. We find that among a population of 110,000, which the city possesses (three-fourths male and one-fourth female), there is a crude death rate of 21 per thousand as compared with 12.2 for London, 18.1 for Paris, 23.1 for Tokyo, 28 for Bombay and 44 for Calcutta. Tuberculosis claims nearly one-fourth of all deaths, which shows that the conditions of living are far from desirable. To cope with the evil, we are introducing public health and maternity nursing among other activities, and hope that the next few years may witness considerable improvement in the health of the people. I hope to make a similar survey of Newchwang from the beginning of 1927.

8. At request of the Waichiaopu and Neiwupu I attended the meeting of the Advisory Council of the Health Bureau of the League of Nations at Singapore from January 4-8. As the Chinese Government representative I gave an outline of our plague prevention work in this part of the world and was pleased to see that a motion proposed by Dr. Rajchman, Director of the Health Section, Geneva, for the appointment of a research commission to investigate tarabagan and other epidemiological questions connected with pneumonic plague, was unanimously passed.

9. The National Medical Association of China held their sixth Annual Conference in Shanghai from Jan. 16-25, our Service being represented by Senior Medical Officer J. W. H. Chun. I sent a paper on the "Development of Medical Work in China," while Dr. Chun read one on "Remarks on the Scarlet Fever Streptococcus Antitoxin." It is interesting to relate that as a result of my visit to Chicago in 1925 members of our Service were the first to introduce this new and important line of research into the Orient. In September, I attended the Conference of the China Medical Association held in Peking and read four papers prepared by our staff.

10. I take pleasure in informing you that the League of Nations is publishing a "Treatise on Pneumonic Plague" by me which will appear at the end of the present year. It covers over 400 pages with both coloured and half-tone illustrations and will, I hope, be the standard work of its kind for many years to come. Volume V of our Service

Reports, containing publications and articles contributed by members of our Service during 1925-26 will be out in November 1926. There will be both an English and a Chinese edition.

11. The Imperial University of Tokyo (Japan) has been kind enough to confer upon me on June 14 the highest medical degree of *higaku-hakushi*—the first ever conferred upon a non-Japanese.

12. I left Harbin on May 19 on a tour of inspection to the out-station hospitals on the Sungari, and visited in turn Sansing, Fuchin, Lahasusu and Taheiho. Owing to unusually dry weather in the spring the trip was more difficult than usual, the steamer taking ten days instead of five for each voyage. In June I visited our hospitals at Manchouli, Hailar and Newchwang. I am glad to report that progress is being maintained everywhere.

13. During the summer we finished the construction of the new model Plague Block in the East Compound of Harbin Hospital. This building is a one-floor red-brick structure, measuring 60 ft. wide by 78 ft. long with specially large windows. An important feature lies in the presence of long and high glass partitions with sliding panes between an observation niche and each patient's ward, so as to allow full freedom of movement and observation to the medical staff for studying and treating patients without unnecessary exposure. An emergency laboratory and post mortem room are also included in the building. The total cost is $7,000.

14. The following figures show the number of outpatients treated at various station hospitals during the last five years :—

	1925-26.	1924-25.	1923-24.	1922-23.	1921-22.
Harbin	16943	22874	15661	15343	9345
Taheiho	3246	4669	7327	8037	4290
Sansing	3816	6603	4379	5235	4054
Lahasusu	2388	1629	1569	1470	2213
Newchwang ...	6263	4675	4100	3693	3043
Manchouli	1674	3234	2214	2347	2291
Hailar	2567	—	—	—	—

15. The personnel of the Service for 1925-26 are as follows :—

Dr. Wu Lien Teh, Director and Chief Medical Officer.
Dr. J. H. W. Chun, Senior Medical Officer, Harbin.
Mr. U. Marconi, (Commissioner of Customs) Lay Director & Treasurer.
Dr. Lin Chia Swee, Senior Resident Medical Officer, Harbin.
Dr. R. Pollitzer, Bacteriologist, Harbin.
Dr. H. Jettmar, Serologist, Harbin.
Dr. E. B. Young, Senior Resident Medical Officer, Newchwang.
Dr. C. L. Shih, Resident Medical Officer, Sansing.
Dr. Y. M. Kwan, Resident Medical Officer, Taheiho.
Dr. Li Yuan Po, Resident Medical Officer, Manchouli.
Dr. Shih Wei Hua, Resident Medical Officer, Antung.
Dr. Chow Soo Bin, Assistant Medical Officer, Harbin.

Winter view of the new buildings (Hospital Administration and Laboratory Blocks) from the inside of the West compound.
The General Hospital erected in 1922 is at left, in middle is the Administration Block, built in 1920. The large block with the Tower is the Laboratory completed in 1924.

新建築冬季攝影(養病室及研究室)由西院內部觀察位於左側者爲總養病室一九二二年落成
位於中央者爲總處辦公室一九二〇年落成其中有高出之塔樓者卽研究室也一九二四年落成

Summer view of the West Compound showing parts of the same buildings.

西院夏季攝影示前述各室位置

Winter view of the East or Infectious compound. In times of epidemic, cases of Plague and Cholera are admitted here. The six long blocks are for housing the patients.

傳染病隔離所在冬季攝影（東院）當鼠疫或霍亂流行時所有患者收容於此有長室六座即疫病室也

The new Laboratory block from the West, 1926.

新研究室由西視

The joint Administration and Laboratory block from the South, 1926.

新研究室由南視且示與總處相連

Staff of the North Manchurian Plague Prevention Service, taken in Harbin, Summer 1926.

[illegible]東省防疫處職員在一九二六年夏攝

A corner of the Museum.

博物室之一隅

Dr. Z. L. Young, Assistant Medical Officer, Harbin.
Dr. Li En Chang, Assistant Medical Officer, Sansing.
Dr. Liu Hsing Chi, Resident Medical Officer, Hailar.
Mr. Tung Lan Chi, Senior Dresser in charge, Lahasusu.
Miss Liu Chi Chieh, Deputy Female Medical Officer, Taheiho.
Miss N. C. Chung, Senior Nurse, Harbin.
Miss Liu Tzu Ming, Senior Nurse, Newchwang.

16. In conclusion, I wish to take this opportunity of expressing my thanks to various departments of the Chinese Government, to the Chinese Eastern Railway and the South Manchurian Railway for facilities granted to us in the prosecution of our work. As in the former years the Soviet Government has offered frequent facilities for our investigations. We are also indebted to the Customs Officers throughout Manchuria for asssistance rendered to our Service. Finally, I beg to record the faithful and unfailing devotion to duty shown by members of our staff.

I have, etc.,

WU LIEN TEH,
Director and Chief Medical Officer.

SUMMARY OF FIFTH ANNUAL GENERAL REPORT, QUARANTINE HOSPITAL, NEWCHWANG.

Sir,

I have the honour to submit a summary of the Fifth Annual General Report of the Newchwang Quarantine Hospital for the year July 1, 1923 to June 30th, 1924.

2. The past year has been a very peaceful one so far as communicable diseases are concerned. No plague or cholera has been reported here or elsewhere in Manchuria. So far only a few isolated suspicious cases of cholera have occurred in the Shanghai district, and none in Japan or Korea. Occasional cases of Influenza seen were mild, and both Typhus and Smallpox were absent. In India, however, there has been a return of the Bubonic plague epidemic in a virulent form this spring, no less than fifty thousand deaths having so far occurred since the beginning of the year. In Hongkong and Canton, several cases have also occurred, and in consequence the latter city has been declared an infected port by our local authorities.

3. Our new Quarantine Blocks, construction of which was started on June 1st of last year, are now practically completed. They consist of three long rectangular buildings, each 150 ft. by 24 ft. and fitted with an attendant's room, a baggage room and two parallel rows of hygienic *kangs,* consisting of wooden boards resting on ferroconcrete supports, absolutly fire proof and rat-proof. Each of these big blocks can accommodate 80 to 100 persons. Besides there is a female block holding 40-50 persons as well as a fifth L-shaped block for private families, in addition to kitchen and servants quarters. Altogether 400 persons may be accommodated in times of need. Five sets of separate latrines, built of concrete slabs with cement foundation, all rat-proof and flyproof, have also been completed. Only the examination room and adjoining wash-rooms are needed to complete the whole job. It may be mentioned that the cost of these buildings has been defrayed from some money left over from our original construction funds as well as from savings effected during the last few years from our annual appropriations. The planning of these model quarantine blocks for China has meant considerable attention to details, and great credit is due to Mr. P. W. Fawcett, Chief Engineer of the Lower Liao River Conservancy Board, and concurrently our architect, for having put into practical shape my advice and suggestions. The blocks are separated from one another and from the rest of our hospital by nine rows of barbed wires supported on concrete posts. Some photos are attached.

4. The addition of this fine Quarantine Camp at Newchwang will also raise the status of the port to very near a first class one according to the standard recently adopted by the Health Committee of the League of Nations (March 1924). It may be remembered that Dr. Norman White made an extended tour through the East early in 1923, visiting Newchwang among other places. His report issued a few months ago is a masterpiece of conciseness and accurate information on the health conditions of the Orient, and among his recommendations are: (1) the establishment of a Central Epidemic Intelligence Bureau at Singapore and (2) the grading of seaports into three classes according to certain requirements fulfilled, such as water supply, medical and laboratory staff, quarantine and infectious diseases hospitals, disinfection facilities, etc. This will mean that Newchwang and Dairen will rank among first class ports, while Shanghai, Tientsin, and Hongkong will be called second class. It is hoped that as a result of Dr. White's recommendations countries in the Far East will co-operate more heartily in international health work and thus suppress dangerous communicable diseases like plague, cholera, Typhus and Smallpox.

5. The number of outpatients treated in the year is 4371. 69 inpatients (51 M. and 18 F.) were admitted, consisting of 18 medical and 51 surgical. Included among the latter were two Typhoid, both fatal. No Smallpox cases were seen. We are now able to compare the incidence of cases seen according to seasons of this year as compared with previous years :—

SUMMARY OF FIFTH-ANNUAL GENERAL REPORT.

	1923-4	1922-3	1921-2	1920-1
July	471	361	261	224
August	442	381	252	376
September	384	230	200	289
October	303	228	275	284
November	256	348	218	236
December	304	258	382	191
January	326	252	220	213
February	203	282	220	154
March	506	269	164	437
April	359	331	309	292
May	411	454	324	281
June	393	298	218	212
Total	4371	3693	3043	3225

6. A few interesting items connected with our routine work may be herewith summarised :—

a. On account of plague in the south in 1923, quarantine was declared against Hongkong and Canton from July 13 to Sept-

ember 8. Number of steamers examined by our medical officers during this period was 7, and passengers 204. None were detained.

b. Owing to the prevalence of Cholera in Shanghai in 1923, quarantine was declared against that port from August 22 till October 1. During this period 40 steamers were examined with 1435 passengers. None were detained.

c. Population of Newchwang (kindly supplied by our Police as well as by the Japanese Consul) is as follows :

Chinese 73,000; Japanese (including railway area) 2300; Whites 120.

d. Number of Prostitutes (Chinese)—

First class	105	
Second class	99	
Third class	668	Total 872.

e. The first snow-fall occurred in October 20th, 1923, The Liao River was frozen from January 20th, till March 19th, 1924.

f. Quarantine was declared against Canton this year on June 2nd.

7. We are fortunate in having two very keen and experienced officials in the persons of Taoyin Mr. Tung Tao Yuan (佟兆元) and Superintendent of Police, Mr. Li Chia Ting (李家鼎). The former has been indefatigable in his efforts to widen and repair the streets and render the city cleaner and more up-to-date, and has obliged the house owners, especially along the main street to give up part of the pavement, which they have in the past invaded, so as to facilitate communications. The Commissioner of Customs, Mr. R. L. Warren, has worked very hard through the Liao River Conservancy Scheme to make the port more inviting and accessible to steamers and thus increase its trade and prosperity.

8. The new scientific report 1923-24 of the Manchurian Plague Prevention Service is finished and ready for distribution. Among the articles is a very able one on "Scarlet Fever in China" jointly by Dr. E. B. Young (Senior Resident Medical Officer of this hospital) and Dr. W. H. Shih (of Taheiho).

9. In conclusion, I have to acknowledge the courtesy and helpfulness of Mr. R. L. Warren, Customs Commissioner. Dr. E. B. Young has performed his duties creditably and faithfully.

WU LIEN TEH,
(Director and Chief Medical Officer.)

June 30, 1924.

SUMMARY OF SIXTH GENERAL ANNUAL REPORT, QUARANTINE HOSPITAL, NEWCHWANG.

Sir,

I have the honour to submit a summary of the Sixth Annual Report of the Newchwang Quarantine Hospital for the year July 1st, 1924, to June 30th, 1925.

2. Dr. Wu Lien Teh, our Director and Chief Medical Officer paid us a visit on June 21st, to 23rd, 1924, on his way to America for a year's leave of absence.

3. During the Quarantine period from June 2nd, to August 30th, 1924, against Canton for being plague infected there were examined four steamers with thirty-five Chinese and one foreign passengers. None were detained.

4. Plague Reports for the past year.

a. Two fatal cases of plague were reported in August, 1924, from Substation No. 83, near Dauria of Siberian Railway. One fatal case was reported in September from Dalanor village in Siberia.

b. Plague in British India caused the death of 45,529 persons from May 11th, to July 12th, 1924.

c. Plague in Egypt caused 35 deaths from June 11th, to August 12th, 1924.

d. Plague in Java caused 1668 deaths during last October.

c. Plague in Los Angeles, California—There were 32 pneumonic types with 30 deaths from October 29th, to November 7th, 1924. Also 3 bubonic cases with 2 deaths during this period. The last fatal pneumonic case occurred on January 11th, 1925. One recovery from bubonic plague was also reported from this date. Since then no further outbreak has been reported.

f. During February 1925, three fatal cases were reported from Turga district in Transbaikalia, half way between Chita and Borzia.

g. A Russian hunter, named Hudaiff, age 42, died from pneumonic plague on May 24th, in a village near the station Hohonteh of the Chinese Eastern Railway, half-way between Hailar and Manchouli. His comrade, Tibulart, age 30, developed left axillary bubo, but recovered. There were also seven contacts. Thanks to the co-operation of the railway doctors with Dr. Li An of our Plague Prevention Service at Manchouli hospital, nothing serious has occurred among the contacts.

5. The following statistics were kindly supplied by our Police Chief and by Mr. M. Kimura of the Japanese Consulate.

Population of Newchwang—

Chinese about	80,000	
Japanese	3,456	including S.M.R. area.
Europeans	132	including 12 Russians.

Number of Prostitutes in Newchwang-Chinese. Japanese.

1st. class	105	69 in all.
2nd, class	116	
3rd. class	332	
4th, class	226	
Total	779	

Number of Births and Deaths in Newchwang from January 1st. to May 31st, 1925, of the Chinese population are as follows :

Births totals ...... 253 Deaths total ...... 335.

6. There was a mild outbreak of Scarlet Fever and of Small-pox in the city during the winter months. Eight cases of Smallpox occurred among the soldiers resulting in the death of 3.

7. New Detention Camp.

a. One block was occupied by the naval unit from September 18th, to November 22nd, 1924.

b. The other four blocks were occupied by the new military recruits from October 1st, 1924 to March 13th, 1925.

8. Upwards of 2000 new military recruits were examined by us. Among those rejected from military duty were the following :—

80 Morphine habitues. One was under 18 years old.
15 Syphilis in all its stages.
25 Tuberculosis.
40 Between 50 to 60 years old.
19 Over by 60 years old.
21 With defective vision.
3 Died from Smallpox.

9. The number of outpatients treated during the year is 4342 with 549 female cases and 11 obstetrical cases. The number of inpatients treated was 52 (45 male and 7 female) consisting of 42 surgical and 10 medical cases. The following are figures showing the number of outpatients treated each month during the last five years.

HOSPITAL NEWCHWANG.

	1924-5	1923-4	1922-3	1921-22	1920-21
July	456	471	361	261	224
August	452	442	381	252	376
September	361	384	230	200	289
October	438	303	228	275	284
November	672	256	348	218	236
December	129	304	258	382	191
January	80	326	252	220	213
February	135	203	282	220	154
March	241	506	269	164	473
April	413	359	331	309	292
May	438	411	454	324	281
June	527	393	298	218	212
Total	4342	4371	3693	3043	3225

10. The first snowfall was on November 18th, which lasted for three days. The Liao River was not completely frozen over as from the Native Customs across to the Peking Mukden Railway jetty.

The port was open on March 12th, 1925, by the arrival of S. S. Tung Yuan from Lungkow.

11. We have a new Co-Director and Treasurer in the person of C. F. Johnston, Esquire, who took over the duties of Commissioner of Customs from Mr. R. L. Warren on April 15th, 1925. Mr. R. L. Warren left here on furlough on April 18th, 1926.

Mr. Pei Kan Too is the new chief of the Fishery Bureau. He relieved Mr. Pang as from April 25th, 1925.

The new Mayor of the Municipality is Mr. Wang Chung Pu (王中甫) a returned commercial student from America. He relieved Mr. Chu as from May 9th, 1925.

12. In conclusion, I take this opportunity to thank the Commissioners of Customs, (both Mr. R. L. Warren and his successor, Mr C. F. Johnston,) the Port Health Officer, and the local officials for their kind help and assistance. Am indebted to Dr. Walter M. Dickie, Secretary and Executive Officer of California State Board of Health, for a complete report of the Los Angeles outbreak. Finally, to express my appreciation to our staff for their faithful performance of duty.

E. B. YOUNG,
Res. Med. Off.

June 30, 1925.

SUMMARY OF SEVENTH ANNUAL GENERAL REPORT, QUARANTINE HOSPITAL, NEWCHWANG.

Sir,

I have the honour to submit a summary of the Seventh Annual General Report of the Newchwang Quarantine Hospital for the year July 1, 1925 to June 30, 1926.

2. Owing to the prevalence last year of Cholera in epidemic form in Shanghai and other southern cities, we instituted stringent precautions at Newchwang. Medical inspections were started on August 8, 1925, though actual quarantine against Shanghai was not formally declared until August 19.

One corpse examined on S.S. Pakhoi arriving from Shanghai on August 9, was found to be due to heart disease.

One case of proved Cholera occurred on S.S. Tung An (東安) arriving from Shanghai on August 31. As a result, the whole ship-load of passengers, numbering 53, were detained in our Quarantine Camp from August 31 until September 4. None of the contacts showed the disease and all were released.

3. Quarantine against Shanghai was withdrawn on October 19, having thus lasted exactly two months.

During this period, our Medical Officers examined 46 steamers together with 2024 passengers. In the city 8 suspected cases were examined with one positive case from Liaoyang.

In Shanghai 151 deaths from Cholera were recorded among about 2000 cases.

In Manila 73 cases were reported with 20 deaths. In Siam 145 cases occurred with 72 deaths. In French Cochin China, there were 160 cases.

Altogether, the year 1925 was a bad year for Cholera.

5. During the year 5812 outpatients were treated (incl. 1001 Females). The number of in-patients was 62, of whom 44 were surgical and 18 medical.

6. The following statistics are interesting :

(a) Date.	Outpatients treated.	Inpatients treated.						
1920-1	3225	Med.	21,	Surg.	22,	Total	43
1921-2	3367	,,	10,	,,	0,	,,	10
1922-3	2919	,,	44,	,,	21,	,,	65
1923-4	4412	,,	10,	,,	18,	,,	28
1924-5	4343	,,	10,	,,	42,	,,	52
1925-6	5812	,,	18,	,,	44,	,,	62

(b) Infectious Diseases treated in same year were :

	1920-1	1921-2	1922-3	1923-4	1924-5	1925-6
Plague	—	—	—	—	—	—
Cholera	—	—	36	—	—	—
Typhoid	2	—	—	1	—	—
Diphtheria ...	1	—	—	—	—	—
Scarlet Fever .	2	—	—	—	—	—
Smallpox	1	—	—	—	—	—

(c) Percentages of three important diseases among out-patients were :

	1920	1921	1922	1923	1924	1925	1926
Syphilis	10	12	21	20	10	8	6
Gonorrhea ...	12	15	20	18	14	10	9
T. B.	20	16	12	10	9	8	6

7. The following figures regarding population are supplied by the Chief of Police :

Chinese	105,871	
Japanese	326	(Chinese city)
British	80	
Russian	29	
American	5	
Sweden	3	
French	1	
Danish	1	
Korean	109	
German	1	
	555	Total foreigners.

In addition there are 2927 Japanese in S. M. R. zone.

8. Numbers of prostitutes are :

	Chinese City.		S.M.R. area.
	Chinese	Japanese	
Class 1	84	69	30
2	157		
3	307		
4	270		
5	50		
	868	69	30

Total Chinese 868 and Japanese 99.

9. Movements of personnel are as follows:—

Mr. Y. Kurematsu replaced Mr. C. F. Johnston as Actg. Commissioner of Customs on Oct. 16, 1925.

Magistrate Chin Chao Hua replaced Mr. Chen on May 23, 1926.

Mayor Wang Ching Pu has been absent on sick leave since March 16, 1926.

Nurse Liu Szu Ming replaced Nurse Chu in Oct., 1025.

Dresser Lu Pin San joined the hospital on Oct. 4, 1925.

10. Up to date we have spent the following sums upon the Hospital:

Original hospital blocks ....Mex.	$30,000
Mortuary	1,200
Store Room	276
New Quarantine blocks (1924)	40,900
Mex.	$ 72,376

This year we spent $550 upon painting the buildings. The work was undertaken by our own attendants. $700 were spent upon drugs and dressings.

11. The first snowfall of the year was on Nov. 30, 1925. The River Liao was closed to traffic from January 1, 1926 till March 14, 1926.

E. B. YOUNG,
Res. Med. Off.

July 15, 1926.

SUMMARY OF THE HARBIN HOSPITAL REPORTS FROM MARCH 1924 TO SEPTEMBER 1926.

1. *New Buildings.* In the spring of 1924, the Wai Chiao Pu sanctioned the expenditure of $25,000.00 for the building of the new laboratory block. This much-needed addition was realized in the shape of a two-storey, well constructed building with a 106 feet frontage facing the street, and joined on to the administration building by a common entrance and stair-case. The whole building is heated by hot water system; the rooms are airy and well lighted. On the first floor are the plague research room, general laboratory including space for chemical analysis, serological room, clinical analysis room and a dark room. On the ground floor are situated the museum, the library, the preparation room for cultural media and a bath room. A central stair-case provides entrance for persons who have been in touch with infectious disease or for the bringing of infectious material into the laboratory. In the basement there is accommodation for housing laboratory animals in the winter, also for sleeping quarters for some of the lower staff, but these two sets of rooms are entirely separate. The accommodation for the laboratory has been steadily enlarged. For up to 1919, two rooms of the bungalow style were used. When the present administration block was completed, two large rooms therein were assigned for laboratory purposes. It was realized, however, that not only the space was inadequate, but also it was not safe to concentrate laboratory, offices and doctor's quarters all in one building. Now we have a distinct and separate block with five large rooms devoted to research work.

In 1926, pursuing the scheme to gradually replace the old plague blocks in the East Compound, a new model pneumonic plague ward was built, designed to house a dozen pneumonic patients. Special facilities are installed to enable the medical staff to observe the patient, conduct investigations and administer serum injections without being in the same room by an arrangement allowing of a glass partition containing a small window for each ward, through which the patient's arm can be thrust. In the building, a temporary laboratory, a post mortem room, two disinfection rooms, and attendant's room are included. The whole block is airy, light and sanitary, the floor being made of concrete.

2. A mild epidemic of influenza occurred in March 1925. Many persons were attacked, including some of our staff. Twenty-three cases were seen among the out-patients, but the type was not severe and no complicating pneumonia was detected.

3. A small-pox epidemic appeared in the spring of 1925. Though a few only came to the hospital for treatment, there were really large numbers in the Chinese city. Much alarm was caused among the popula-

tion so that many people came for vaccination; during April and May 2000 vaccinations were performed, while 50,000 people were reported to have been similarly protected in the town.

4. *Scarlet Fever* has lately been with us during the winter months; the type is always severe among the Chinese, though apparently not so bad among the Russians. But we had an unusually large number in the city in December 1925 so much so that most of the schools were closed. We tried the scarlet fever streptococcus antitoxin from America, made after Dicks' method and Dochez's method on a few of the severe cases but the results have not been encouraging, 6 out of 7 patients dying.

In the laboratory we have been manufacturing our own antitoxin. Cultures from the throats of patients suffering from virulent scarlet fever were taken, and the causative organism, streptococcus haemolyticus, was isolated and grown in bouillon. The toxin contained in the filtered bouillon, was diluted and standardized and with it the Dick's test for susceptibility to scarlet fever was done, immunization of man against infection and the production of antitoxin in the horse for therapeutic purposes could be accomplished.

Our antitoxin was produced by the Dochez method and has been used on local cases; the results will be observed and published. An attempt was made to immunize the public against scarlet fever and we established four centres in the city where people of both sexes and of all ages could be injected with the diluted toxin. Some two thousand persons were thus protected against a disease which could be more easily prevented than treated.

5. Every autumn cases of bubonic plague were reported from Transbaikalia, as witness the occurrence of three cases near Haranor in September 1924, again at Turga in August 1925, one case at Birka, and two cases in Haranor in August 1926. In June 1925, however, two cases of bubonic plague were reported from Hohonteh in Manchurian territory, and again in September 1926 one case from Manchouli itself. These cases had been in contact with the tarabagan among which plague is endemic. For this reason the Tsitsihar Governor prohibited the hunting and export of the tarabagan skins for five years. In September of 1925 however, this ban was lifted and hunters were once more permitted to trap and skin this commercially valuable animal.

Provisions had to be made to safeguard the hunters and others against plague infection and our Service made and enforced certain regulations for the registration, teaching and supervision of the hunters and the disinfection of the skins. Two bureaux were established respectively at Manchouli and Hailar for this purpose. This work is highly important and upon it depends largely the successful control of the plague situation of the endemic areas.

6. In the summer we have to contend with bowel diseases. Gastroenteritis, and dysentery are exceedingly frequent, especially if the season is dry and flies are plentiful. Though cholera appeared in Shanghai yearly, Harbin has been clear since 1919. In August 1926 cholera

broke out in Harbin. Most likely the disease was brought from Shanghai by carriers. The first cases appeared in a bean curd factory in the Chinese city on the 6th Gradually the disease spread and both Chinese and Russians were attacked. The epidemic was not large luckily and our hospital admitted only 168 cases Once more we demonstrated the effectiveness of the hypertonic saline infusion and we were able to save 82.8 per cent of our patients.

7. During this period of two years and seven months under review the number of out-patients and in-patients have both increased in number, the former amounting to 39,817 as against 29,552 for a similar period as reported in Service Report Vol. IV; and the latter 1140 as against 738. In consequence operations under anaesthetic have also increased in number, 444 as against 361. Our operating technique is now so perfected that we almost always obtain healing by first intention in clean cases. For the last eighteen months we have been using spinal anaesthisation by injecting tropocaine intrathecally in suitable cases. We have used this method 22 times including operations for herniotomy, appendisectomy, piles, fistula in ano, amputations etc., etc., and have found it most useful and advantageous. In passing, we note again that the northern Chinese are exceedingly "good" patients, for they possess courage, faith, hope and charity. In consequence we are leaning to the frequent use of regional anaesthesia and spinal anaesthesia, and rely less on general anaesthesia, being fortunate in the possession of patients who are generally not "nervy". The technique consists of the introduction of the needle in the 3rd or 4th, lumbar intervertebral space and withdrawal of 1 c.c. of cerebrospinal fluid; then 1 c.c. of a freshly made 5% solution of tropocaine in normal saline is injected. The patient is made to lie supine; in 10 minutes, anaesthesia of the lower parts of the body from the umbilicus downwards is obtained.

We made a special effort to spread public health knowledge among the people in the town. Dr. C. S. Lin started to edit a bimonthly magazine on public and personal health in July 1924. The object is to circulate them among the officials, merchants and students, telling every day health facts in a simple language and attractive style. It was hoped that this magazine would do some good in the line of broadcasting some knowledge of hygiene.

In order to obtain vital statistics of the town, such as population, number of births and deaths, infectious diseases, and causes of death, we sent out four sanitary inspectors, one to each ward of the city for co-operation with the police. General practitioners are asked to notify the occurrence of infectious diseases. By a general co-operation we hope to make the town more healthy and we can assist the authorities with good advice and expert services. For instance, in our laboratory we do analytical work for them and have examined patent medicines and sometimes helped to decide medico-legal questions.

8. A few cases of interest may be cited :—

(a) *A case of excision of the elbow for T.B.* may be mentioned. Mrs. Wang, aged 19, has been staying in the hospital for

this disease. She was a well nourished woman with a healthy complexion. The left elbow was swollen and hot; a sinus was present at the olecranon process. A necrosed bone, the size of a thumb nail was removed soon after admission but the sinus refused to heal. At the interval of 3 or 4 months, two scraping operations were performed with no better result. Injections of bismuth and Iodoform and sun baths also failed. As the muscles above and below the joint were not atrophied, and as the X-ray revealed diseased bone involvement of the joint surfaces of the humerus and ulna, it was decided to excise the joint. At operation, the joint was widely resected and the limb was put up in splints with the elbow at a right angle. A month afterwards the wound was almost completely healed, and the joint was not swollen nor inflamed. Movement was not fully regained, but the patient felt much better and left the hospital.

(b) *T.B. cystitis.* Wang, aged 31, complained of pain in the left loin three months before admission. The pain was occasional and never severe. Two months ago he had frequency in micturition and great pain, worse at the end and located in the perineum. He experienced slight fever daily and gradually got thinner. On examination he had light coloured hair, was pale and thin. All the organs were healthy except a suspicious spot in the right apex. The left loin seemed to be fuller, but not tender. Nothing abnormal was felt in the abdomen. No vesical calculus could be felt by the sound. The urine was cloudy, containing a little blood and mucus, acid in reaction. T.B. was seen twice in the urine. It was thought advisable to explore the left kidney, but on exposure by the lumbar route, the organ was found to be healthy and normal in size, so the wound was closed. Von Pirquet reaction was positive. The prognosis was very grave. Tuberculin was given systematically for a month with no improvement.

(c) *Two cases of ankylostomiasis.* Hook-worm disease is comparatively rare in Manchuria and therefore deserves mention. A man, aged 30, lived near Harbin for 20 years, and has never left the locality. It seems he got his infection in Manchuria. He had marked anaemia and the eggs of ankylostomum were seen in his stools. Though a course of thymol and a course of chenopodium oil were given, and many worms were got rid oft, he became impatient and left the hospital before a complete cure was achieved.

The second case was that of a young man of 21. He came three months ago to Harbin from Hunan where he was looking after buffaloes. On examination, he was exceedingly anaemic, puffy and stunted. He had a light yellow colour, his eye-lids, scrotum and legs were swollen. There was a haemic murmur at the base of the heart, and the blood showed a severe secondary anaemia with large numbers of eosinophile

leucocytes. The stool contained many eggs of the ankylostomum. Thymol, naphthol and chenopodium oil were given and he gradually improved.

(d) *Two cases of Carcinoma of the ovary.* Mrs. Lin, multipara, 44, complained of swelling of the abdomen for four months. Lately she has also become thinner. On examination, the abdomen was distended with free fluid and a large nodular tumour could be felt rising from the pelvis. At operation, the tumour was found to be from the left ovary, half solid and half cystic, but there were hard nobs on it suggestive of malignancy which was proved microscopically afterwards. The peritoneum was found to be free and no other organs were involved. The whole of the left appendage was removed and the abdomen sewn up. The patient regained strength gradually.

The second case, age 52, menopause for 3 years, started uterine bleeding for 1 month, six months before admission. The abdomen has gradually increased in size. Meanwhile she was losing weight. On examination, there was no bleeding. The vault of the fornices was hard and filled up. She was a pale and thin woman. A large notched, hard and freely moveable tumour could be felt to occupy the lower abdomen and both flanks. There were 5-6 hard glands in each axilla. None elsewhere. At operation, the abdomen was opened by a paramedial incision of ten inches. The tumour was found to be connected with the left ovary by a pedicle. The tumour was removed by clamping and cutting the pedicle. No abdominal glands were felt or seen. The uterus was small and hard. The right ovary was slightly large. The abdomen was closed and the patient made a good recovery. The pathologist reported that the tumour weighed ten pounds, with multilocular cysts. At the periphery of the tumour much fibrous tissue was seen. Epithelial cells invaded it from all directions, some from the walls of blood vessels. Some of the cells were degenerated. The tumour was a fibro-carcinoma.

(e) *Septic arthritis of the knee.* A man, 30 years of age, pierced his right knee while in the act of killing a pig. Six days afterwards, he came to the hospital. The wound was already septic: the knee joint was inflamed and distended with pus. Free incision was made in front and the joint drained, but the patient was not doing well. He showed a septic fever and the pain was considerable. Eusol irrigation was used after Carel's method for one week with no improvement. Two incisions were then made, one on each side of the knee and a rubber tube was passed through the joint. By daily syringing through the knee the patient gradually improved. The fever went down after ten days and the wound healed up. The knee became ankylosed afterwards.

(*f*) Caesarian section Mrs. Chu, aged 27, had a history of giving birth to two living children; first one was born with a little difficulty 10 years ago, the second one fairly easily 5 years ago. This time at full term and in labour for 30 hours, she came for help. The pubic rami were very close together; the maternal passage was very narrow, admitting two fingers abreast only. The vulva was swollen through pressure. The foetal head was high up, just within reach of the finger. Seeing it was impossible to deliver the child through the natural route, caesarian section was performed at once and a small male child was extracted from the uterus. Much meconium was found in the uterus. Very little bleeding was encountered owing to the good contraction. The uterus was cleansed, sewn up with catgut and the abdomen was closed. Meanwhile, artificial respiration had to be applied to the baby and we succeeded in making him breathe. Both mother and child did well.

(*g*) *A difficult appendisectomy*. Sua, aged 29, was a drug-store keeper in a town near Sansing. He complained of pain in the right iliac region for three years. The pain appeared to be irregular, aching and lasting for hours or days. There did not appear to be attacks of long duration, nor was there any fever. On examination a definite mass could be felt but no special tenderness. The caecum, at operation, was found to be thickened, the appendix was swollen and inflamed, specially near the tip which was bent on itself. It was moreover firmly bound down and adherent to the posterior wall and curled up behind the caecum. With difficulty it was freed and removed. The stump was tied, touched with carbolic acid and buried by Lambert sutures. The abdominal wall was closed in layers. The patient made a good recovery.

(*h*) *Tuberculous proctitis*. A small girl of 4 years was brought to the hospital with the history that for the last three months, there was difficulty in passing stool, and even then the stools were very thin and small. On examination the anus was much narrowed, admitting a probe only. The cause of the stricture was due to a mass surrounding the rectum. This mass was freely moveable and an attempt was made to remove it. On dissection the mass was found to be annular, one inch long and completely surrounded the rectum. The upper border was difficult to reach but as much as possible was removed. Healthy mucous membrane was reached and stitched to the skin of the anus. The mass proved to be tuberculous. Temporary relief was afforded, but the prognosis was uncertain, as we lost sight of the case.

J. W. H. CHUN,

(*Senior Medical Officer, Harbin.*)

SUMMARY OF MEDICAL OUT-PATIENTS TREATED AT MANCHURIA PLAGUE PREVENTION SERVICE HOSPITALS FROM MARCH 1924 TO SEPT. 1926.

	Harbin Hospital.				Taheiho Hospital.				Sansing Hospital.				Manchouli Hospital.				Lahasusu Hospital.				Newchwang Hospital.				Hailar Hospital.
	1924.	1925.	1926.	Total.	1924.	1925.	1926.	Total.	1924.	1925.	1926.	Total.	1924.	1925.	1926.	Total.	1924.	1925.	1926.	Total.	1924.	1925.	1926.	Total.	1926. (April to Sept.)
I. SPECIFIC INFECTIOUS DISEASES. 特別傳染病																									
(a.) BACTERIAL DISEASES. 細菌病																									
1. Typhoid fever 發疹窒扶斯	33	29	103	165	1	4	3	8	2	0	0	2	5	1	0	6	0	0	2	2	0	0	0	0	17
2. Erysipelas 丹毒	118	134	115	367	0	3	3	6	1	0	0	1	19	13	26	58	1	0	0	1	0	1	0	1	36
3. Diphtheria 窒扶的里	3	5	6	14	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	3	0	0	0	0	1
4. Pneumonia 肺炎	48	60	63	171	0	0	0	0	5	2	0	7	1	0	14	15	7	2	0	9	0	0	0	0	43
5. Influenza 流行性感冒	158	238	109	505	43	14	17	74	0	0	0	0	9	0	0	9	29	2	20	51	0	0	0	0	101
6. Whooping cough 百日咳	35	7	2	44	0	0	0	0	0	35	49	84	0	0	0	0	14	0	4	18	0	0	0	0	6
7. Gonococcus infections 淋菌傳染病	290	531	322	1143	42	39	35	116	13	37	0	50	155	99	69	323	18	58	25	101	6	37	16	59	326
8. Dysentery 赤痢症	188	228	190	606	29	11	38	78	200	77	29	306	0	3	42	45	22	20	4	46	1	0	12	13	70
9. Cholera 虎列拉症	0	1	148	149	0	0	0	0	0	1	7	8	0	0	15	15	0	0	0	0	0	0	0	0	0
10. Plague 鼠疫症	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11. Tetanus 破傷風	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12. Leprosy 麻瘋	5	3	4	12	1	0	0	1	0	0	0.	0	0	6	0	6	5	5	0	10	0	0	0	0	0
13. Tuberculosis 肺結核	781	1088	613	2482	42	11	31	84	129	258	78	465	67	44	52	163	17	42	158	217	5	3	36	44	181
(b.) NON-BACTERIAL FUNGUS INFECTIONS. 黴菌傳染症																									
(c.) PROTOZOAN INFECTIONS. 原生動物傳染病																									
1. Malaria 瘧	66	49	51	166	20	6	28	54	9	11	6	26	0	0	35	35	53	27	1	81	17	17	3	37	53
2. Relapsing fever 回歸熱症	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3. Syphilis 梅毒	820	1564	506	2890	98	77	55	230	59	118	38	215	174	137	89	400	47	81	109	237	0	2	56	58	316
4. Yellow fever 黃熱症	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(d.) METAZOAN DISEASES. 蟲症																									
1. Intestinal Cestodes, Tapeworms 蟯蟲類 帶蟲類	50	30	26	106	0	6	7	13	1	10	21	41	5	4	2	11	0	3	2	5	0	0	0	0	16
2. Diseases caused by Nematodes 線蟲類	0	0	0	0	2	8	2	12	0	0	3	3	7	3	0	10	3	0	5	8	12	12	19	43	9
3. Parasitic Insects 寄生蟲	220	241	137	598	24	4	5	33	0	0	0	0	7	2	1	10	12	5	0	17	143	11	6	160	89
(e.) INFECTIOUS DISEASES OF UNKNOWN ETIOLOGY. 不知病原傳染病	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1. Small-pox 天然痘	4	13	77	94	0	0	0	0	6	5	0	11	2	0	7	9	0	0	0	0	0	0	0	0	24
2. Chicken-pox 水痘	0	0	0	0	5	2	0	7	14	0	8	22	0	0	0	0	1	3	0	4	1	0	0	1	3
3. Measles 麻疹	17	72	28	117	15	1	0	16	8	0	11	19	11	0	19	30	1	0	3	4	0	0	0	0	3
4. Scarlet fever 猩紅熱	0	43	33	76	0	0	0	0	0	0	0	0	2	2	6	10	0	0	0	0	0	0	0	0	2
5. Epidemic Parotitis (Mumps) 流行症耳下腺炎症	36	122	121	279	3	0	2	5	1	3	0	4	20	0	68	88	1	1	12	14	9	4	10	23	70
6. Typhus 發疹窒扶斯	3	4	0	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6
7. Rabies 狂犬症	3	0	1	4	0	0	0	0	0	1	0	1	0	0	0	0	1	1	0	2	0	0	0	0	0
8. Rheumatic fever 僂麻質斯熱症	0	2	3	5	0	0	0	0	0	0	0	0	7	2	23	32	0	0	0	0	0	0	0	0	75
9. Acute Tonsillitis 急性扁桃腺炎	107	127	63	297	21	13	13	47	7	3	0	10	65	16	25	106	16	2	7	25	40	37	30	107	54
10. Acute Catarrhal fever 急性加答兒熱症	71	83	31	185	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
II. INTOXICATIONS. 中毒																									
a. Alcoholism 酒精中毒	3	0	0	3	0	0	0	0	0	0	0	0	4	3	4	11	0	0	0	0	1	0	1	2	1
b. Morphia Habit 嗎啡中毒	34	49	24	107	3	4	2	9	4	3	0	7	1	0	4	5	0	1	1	2	19	2	0	21	5
c. Lead poisoning 鴉片中毒	1	0	0	1	0	0	0	0	0	0	6	6	0	0	0	0	0	0	0	0	1	2	2	5	0
d. Arsenical poisoning 砒霜中毒	0	0	1	1	0	0	0	0	0	0	0	0	4	0	0	4	0	0	0	0	2	0	0	2	0
e. Food poisoning 食物中毒	1	0	3	4	0	0	0	0	0	0	0	0	1	1	0	2	0	0	0	0	0	0	0	0	0
f. Beri-beri 脚氣	3	3	0	6	0	0	0	0	0	0	15	15	0	0	0	0	0	0	0	0	0	0	7	7	0
III. DISEASES OF METABOLISM. 新陳代謝病																									
a. Gout 痛症	0	0	0	0	0	0	0	0	0	0	0	0	10	4	7	21	0	0	2	2	0	0	0	0	13
b. Diabetes 糖尿症	1	4	5	10	0	10	4	14	0	0	0	0	60	2	3	65	2	0	0	2	0	0	0	0	0
c. Rickets and Scurvy 軟骨及癧症	0	0	0	0	0	0	0	0	0	0	0	0	14	24	0	38	0	0	0	0	0	0	0	0	7
d. Rheumatism 僂麻質斯	538	657	356	1551	41	100	84	225	42	80	270	342	143	101	90	334	57	37	45	139	62	23	28	113	74
IV. DISEASES OF THE DIGESTIVE SYSTEM 消化系病	1069	1397	618	3084	208	298	279	785	229	438	444	1111	331	260	231	822	146	150	197	493	402	347	386	1135	258
V. ,, ,, ,, RESPIRATORY SYSTEM 呼吸系症	902	1047	338	2287	242	236	163	641	72	89	48	209	342	192	175	709	71	71	80	222	172	198	238	608	201
VI. ,, ,, ,, GENITO-URINARY ,, 泌尿生殖器病	277	405	109	791	29	0	0	29	30	22	0	50	0	8	0	8	8	5	23	36	212	107	116	435	34
VII. ,, ,, ,, THE BLOOD 血液病	179	211	77	467	3	0	0	3	2	11	11	24	35	6	4	45	0	5	4	9	0	0	0	0	55
VIII. ,, ,, ,, CIRCULATORY SYSTEM 循環系病	146	176	70	392	6	5	3	14	2	21	0	23	22	12	4	38	5	3	11	19	3	3	4	10	69
IX. ,, ,, ,, DUCTLESS GLANDS 無管腺病	62	116	61	239	0	0	0	0	12	27	0	39	0	3	0	3	0	7	25	32	0	0	0	0	96
X. ,, ,, ,, NERVOUS SYSTEM 神經系病	537	580	339	1456	20	6	7	33	43	35	44	122	57	30	35	122	9	21	34	64	63	73	44	180	91
XI. ,, ,, ,, LOCOMOTOR ,, 運動系病	120	146	107	373	0	1	4	5	0	0	31	31	3	4	0	7	0	0	7	7	0	0	0	0	27
XII. ,, ,, ,, EYE 眼病	674	922	395	1991	212	245	221	678	303	458	242	1003	302	178	109	589	117	169	177	463	233	419	380	1032	172
XIII. ,, ,, ,, SKIN 皮膚病	435	504	311	1250	120	124	138	382	1109	730	407	2246	138	61	73	272	144	279	332	755	216	189	211	616	222
XIV. ,, ,, ,, NOSE, THROAT & EAR 耳鼻咽喉病	280	489	253	1022	41	29	61	131	57	84	137	278	117	48	65	230	32	35	59	126	246	352	366	964	158
XV. ,, ,, ,, WOMEN 婦人病	120	315	164	599	6	27	16	49	35	106	280	421	8	0	17	25	30	17	35	82	9	14	24	47	136
XVI. SURGICAL CASES 外科	4434	6873	4951	16258	1232	1188	1337	3757	1206	963	988	4157	0	2	0	2	713	562	483	1758	2029	2421	2909	7359	207
XVII. VACCINATION 種痘	225	2838	3744	6807	179	95	105	379	121	322	11	454	6	0	0	6	49	41	38	128	40	99	78	217	344
XVIII. MIDWIFERY 產科	11	9	13	33	0	0	0	0	75	0	0	75	24	5	0	29	0	0	0	0	4	7	0	11	1
Total	13108	21415	14692	49215	2688	2567	2663	7918	3797	3950	3184	10931	2178	1276	1314	4768	1634	1655	1905	5194	3948	4380	4982	13310	3676

SUMMARY OF IN-PATIENT DISEASES.
From March 1924 to August 1926.

	Harbin Hospital.	Newchwang Hospital.
Fracture and Dislocations. 骨折及節脫		
Fracture Wrist 腕	1	0
,, Thigh 大腿	2	0
,, Tibia 脛	6	2
,, Spine 脊柱骨折	1	0
,, Skull 顱頭	0	4
,, Rib 肋骨折	0	1
,, Radius 橈骨折	0	1
,, Shoulder 肩	1	0
Dislocation Shoulder 肩胛脫臼	1	0
,, Hip 大腿關節脫臼	1	0
Injuries. 外 傷		
Sprain 扭傷	1	0
Contusions 挫傷	9	0
Frost bite 凍傷	2	0
Kick 馬踢	1	0
Bites 咬傷	4	0
Gun Shot 槍彈傷	62	4
Crushes 壓傷	2	0
Cut Throat 頸處自刎傷	1	0
Concussion 受震	1	1
Stabs and Wounds 刺及槍	27	14
Scalds 燙傷	2	0
Burn 火傷	6	4
Diseases of Genito-Urinary System. 生殖及泌尿器病		
Nephritis 腎炎	11	0
Phimosis 包莖	19	1
Stricture urethra 尿管狹窄	4	0
Bubo 橫痃	17	8
Gonorrhoea 淋病	10	1
Orchitis 睾丸炎	6	0
Syphilitic chancre 下疳	10	0
Soft ,, 軟下疳	2	0

	Harbin Hospital.	*Newchwang Hospital.*
Cystitis 胱炎	3	0
Renal Stone 腎石	1	1
Rupture of bladder 膀胱破裂	1	1
Spermatorrhaea 夢遺	1	1
Epididymitis 副睪丸炎	2	0
Scrotal fistula 陰囊瘤管	0	2

Diseases of Alimentary Canal and Digestive System. 消化管及消化系病

Colitis 腸絞	1	1
Dysentery 赤痢	9	1
Typhoid 腸窒扶斯症	17	1
Enteritis 腸炎	9	5
Cirrhosis Liver 肝變硬症	3	0
T. B. Peritonitis 腹膜結核	3	0
Hernia 疝氣	5	0
Piles 痔核	35	9
Fistula in ano 痔漏	40	2
Constipation 便秘	3	4
Liver Abscess 肝癰	2	0
Gastritis 胃炎	16	0
Dyspepsia 消化不良	7	0
Appendictis 闌尾炎	1	0
Dilated stomach 胃擴張	1	0
Hook Worm 鈎虫	2	0
Hepatitis 肝炎	1	0
Ascites 腹脹	7	0
Tricephaliasis 鞭虫	1	0
T. B. Proctitis 肛結核	1	0
Stone in Gall Bladder 胆石	1	0
Ascariasis 蛔虫	1	0
Gastric ulcer 胃潰瘍	3	0
Peritonitis 腹膜炎	2	0
Catarrhal Jaundice 加答兒黄胆	2	0
Cholecystitis 胆囊炎	1	0
Paratyphoid 副傷寒	1	0
Cholera 霍亂	148	2

Diseases of Women. 婦人病

Endometritis 子宮內膜炎	1	0
Occlusion of vagina 陰道閉塞	2	0
Vesico-Vaginal fistula 陰胱漏	1	0
Abortion 小產	2	0
Leucorrhaea 白帶	1	2

	Harbin Hospital.	Newchwang Hospital.
Diseases of Circulatory and Respiratory System. 循環及呼吸系病		
Pneumonia 肺炎	12	1
Mitral 僧帽瓣症	1	0
Phthisis 肺結核	37	10
Pleurisy 肺膜炎	15	1
Bronchitis 氣管支炎	11	7
Pharyngitis 喉炎	8	0
Arythmia 心韻不均	1	0
Lymphangitis 淋巴炎	1	0
Laryngitis 喉頭炎	1	0
Tonsillitis 扁跳腺炎	1	0
Endocarditis 心囊炎	1	0
Phlebitis 靜腺炎	1	0
Tumours. 瘤		
Granuloma 芻瘤	3	0
Fibroma 纖維瘤	4	0
Sarcoma 肉腫	5	0
Carcinoma 癌腫	16	0
Papilloma 刺瘤	5	0
Cyst 囊腫	2	0
Keloid 瘢瘤	2	0
Cystadenoma 楊梅濕粒	1	0
Osteoma 骨腫	1	0
Polypus 疣肉	1	0
Epithelioma 上皮腫	2	0
Dental Cyst 牙瘤	2	0
Lipoma 脂肪瘤	0	1
Diseases of Nervous System. 神經系病		
Syphilitic paraplegia 腦梅毒	3	0
Cerebral meningitis 顱腦衣炎	3	0
Tabes Dorsalis 脊髓癆	3	0
Neurasthenia 神經衰弱	9	0
Epilepsy 癲癇	7	0
Hysteria 癔	6	0
Cerebral Haemorrhage 腦出血	2	0
Facial paralysis 顏面神經麻痺	3	0
Mania 癲狂	2	0
Neuralgia 神經痛	3	0
Motor Oculi Paralysis 運動神經痲痺	1	0
Encepalitis 腦膜炎	1	0
Dementia Praecox 癡症	0	1

	Harbin Hospital.	*Newchwang Hospital.*
Habit Spasm 習慣性抽症	1	0
Peripheral Neuritis 全身神經炎	0	1
Septic Cases. 化膿症		
Abscesses 膿瘍	43	5
Ulcers 潰瘍	14	15
Gangrene 壞疽	7	0
Eczema 濕疹	5	0
Lupus 狼瘡	1	0
Carbuncle 癰	9	2
Erysipelas 丹毒	9	0
Gumma 楊梅瘤	4	0
Dermatitis 皮炎	1	0
Cellulitis 連[illegible]炎	19	0
Impetigo 小膿包	1	0
Diseases of the Eye. 眼病		
Pterygium 脺翳	2	0
Entropion 臉捲內	1	0
Trachoma 脺粒炎	17	4
Keratitis 瞭炎	3	0
Conjunctivitis 脺炎	3	0
Cataract 白內瞕	1	0
Stye 粟粒腫	1	0
Iritis 虹彩炎	2	0
Staphyloma 葡萄腫	5	1
Panophthalmia 眼球炎	1	0
Diseases of Bones, Muscles and Joints. 骨節及關節病		
T. B. Bone 骨結核	67	4
T. B. Joint 關節結核	21	5
Necrosis 骨死	7	0
Periostitis 骨膜炎	2	0
Suppurative Arthritis 關節化膿炎	4	0
Gon. Arthritis 淋症節炎	2	0
Spondylitis 脊骨炎	1	0
Osteomeylitis 骨髓炎	3	0
Fevers. 熱病		
Influenza 流行性感冒	8	1
Malaria 瘧	2	0

	Harbin Hospital.	Newchwang Hospital.
Scarlet Fever 猩紅熱	8	0
Measles 痲疹	2	0
Acute Rheumatism 急性僂痲質斯	1	0
Small Pox 天花	15	0
Various. 雜症		
Rheumatism 僂痲質斯	17	0
Pregnancy 孕	29	5
Corns 鷄眼	1	0
T. B. Glands 腺結核	18	5
Splenomegaly 脾大症	1	0
2nd. Syphilis 第二期梅毒	20	0
Anaemia 血虧	1	0
Hare lip 兎脣	2	0
Opium Habit 中鴉片癮	13	0
Opium Poison 中鴉片毒	1	0
Sup. Otitis Med. 化膿性中耳炎	3	1
Nasal Polypus 鼻茸	4	0
Debility 衰弱	2	0
Carbon Monoxide Poison 炭酸中毒	1	0
Lumbago 腰痛	1	0
Urticaria 蕁麻疹	1	0
Purpura 痒疹	1	0
Leprosy 痲瘋癩	1	0
Hypospadias 尿道下裂	0	2
Pyorrhaea 牙窩膿瘍	0	3
Tetanus 破傷風	0	1
Beri Beri 脚氣	0	3
No Diagnosis 未診斷	4	0
	1,140	153

LIST OF OPERATIONS BETWEEN MARCH 1924 TO AUGUST 1926, HARBIN HOSPITAL.

Amputations. 肢截斷術

Toe	脚趾	2
Fingers	手指	4
Arm	臂	9
Foot	足	22
Thigh	大腿	14
Leg	小腿	21
Hand	手	2
Shoulder	肩	1
Forearm	前膊	3

Bones & Joints. 骨及關節

Necrosis	死骨	27
Scraping T. B. Bone	刮骨結核	37
Plating fractures	釘接骨股	1
Dislocation hip	大腿脫臼	1
Extract teeth	脫牙術	7
Draining septic knee	膝關節放膿	5
Arthrectomy knee	膝關節斷術	1
Osteo-myelitis	骨髓炎	8
Setting fracture	骨折整復術	1
Arthrectomy elbow	肘關節斷術	2
Osteotomy femur	大腿骨斷術	1

Genito Urinary. 生殖器及尿道

Castration	割去睪丸	4
Ruptured urethra	尿道破裂	1
Phimosis	包莖術	13
Occlusion vagina	陰道閉塞	1
Urethrotomy	尿道術	5
Explore kidney	腎臟手術	1

Skin, Fascia & Tendons. 皮膚筋鞘靭帶

T. B. Glands	腺結核	6
Cleaning wounds	潔淨傷	6
Abscess	膿瘍	26
Suture wounds	縫創	6
Carbuncle	癰	5
Bullet extraction	取彈	14
Cleaning ulcer	潔潰瘍	4
Bubo	橫痃	8
Cellulitis	蜂窩織炎	1

Tumours. 瘤

Fibroma	纖維腫	5
Cyst	囊腫	1
Sarcoma	肉腫	5
Papilloma	癌腫	4
Granuloma	肉芽腫	3
Ovarian cyst	卵腺囊瘤	1
Keloid	瘢瘤	2
Sebaceous cyst	脂囊	14
Lipoma	脂肪腫	2
Venereal wart	梅毒性疣肉	1
Epithelioma	上皮腫	1
Carcinoma	癌腫	7
Fibro angioma	纖維絡腫	1
Dental cyst	牙瘤	2
Ganglion	坜死	1
Warts	疣肉	1
Angioma	絡腫	1

Alimentary Canal & Abdomen. 育道及腹

Piles	痔核	44
Fistula in ano	痔漏	30
Hernia	疝氣	7
Bullet wound abdomen	腹部彈傷	1
Tap ascites	腹脉穿刺	1
Abscess Liver	肝膿瘍	1
Appendisectomy	盲腸樣剔出術	1
Tonsillectomy	扁桃樣剔出術	1
Cholecystotomy	胆囊穿刺術	1

Eye. 眼

Entropion	眼內捲	3
Cataract	障	3
Excision eye	眼宛割術	7
Pterygium	脺翳	1

Plastic. 畸形術

Hare lip	兎唇	2
Ingrowing nail	甲腐症	2
Excision tatoo	皮色素切除	1
Plastic of lip	唇整形術	2

Various. 雜類

Forceps delivery	施產鉗收生	2
Suturing ulnar nerve	飌顳神經縫合	1
Mastoiditis	乳嘴蜂窩炎	4
Corns	鷄眼	2
Vesico-vaginal fistula	膀胱膣瘻管	1
Caesarian Section	帝皇產科術	1
Amputation Cervex Uteri	子宮頸斷術	1
Excision Malignant pustule (Anthrax)	獸疔切除術	1
	Total	444